THE FOUNDRY

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Nickle Plating.

By G. D. RICE.

The increased use of nickle plated ornamental work in all industries is quite marked. Artistically designed trimmings are now seen on even low-priced articles, improving the appearance and adding to the market value of the same. Having had experience in nickle plating cast iron trimmings, the writer may be able to give a few points of practical use concerning the work. The nickle plating of cast iron ornaments practically begins in the casting room. Not only must the castings be free from burnt spots, but the outlines of the design must be clear. This demands that a good grade of sand be used in molding, that the metal be poured correctly and that the workman be skilled in this particular line of foundry work.

CLEANING THE CASTINGS.

Pickling will usually clean the castings thoroughly, but as the acids used frequently affect the plating, some manufacturers do not use this process, depending upon scratch brushes or revolving brush wheels. The writer has used the pickling process without detriment to the plating operation, by constructing a device such as is shown in section in fig. 1, in which the vat A is brick and mortar, lined with enamel so as not to affect the liquors.

APPARATUS USED IN PLATING CAST IRON TRIMMINGS.

A false bottom B, made of aluminum bronze, is set in on brackets as shown. This bottom is perforated with inch holes. The pickling solution is first put in and the cast iron pieces wired and introduced in the usual way being allowed to remain about 10 minutes. After a dozen or more batches of castings are thus treated the solution is drawn through pipe D and a hot solution or salicornia lye put into the bowl and the batch of castings given a bath in this also. The last liquor is drawn in same way as the first, and cold water run in through pipe E. The spout C is connected with the pipes D and E, and the flow is governed in each pipe by the valve stems F, F. The water is admitted till the bowl is full, one batch of castings is rinsed in it, the water is then run off through D, another quantity run in through E, another batch of castings rinsed and so on.

POLISHING THE CASTINGS.

For first roughing a No. 70 emery wheel is about right, and for second roughing a No. 90. No. 120 makes a good final wheel. Common wood wheels, turned to a convenient size and surfaced with emery flour are most serviceable, although it is not out of the ordinary to find canvas, hair, felt, leather and other wheels in use in the roughing work. For "finishing down" the latter wheels are of course indispensable. Felt wheels are particularly useful as they conform to the shapes of the castings. "Greasing" comes next, and is done effectively on greased 170 emery wheels. Tallow and beeswax, mixed with ground pumice stone and applied to the surface of the greasing wheels, gives good results. "Glazing" is next and if done well will remove all scratches and put a fine glaze on the casting. A good glazing or coloring wheel can be made by working down a No. 170 emery grease wheel until the surface is quite hard and flint like.

PLATING THE CASTINGS.

As the plating department is required to be in a separate room, and is in fact a distinct branch of the business, a ground plan of such a department is shown in figure 2 in which the location of the tanks, benches, plating outfit, etc., is indicated. The solution tanks are lined with asphaltum and connected with the stone jar by cement coated pipes. The hot water tanks are connected with heating pipes that extend beneath the floor. To avoid rust marks, which almost invariably appear on cast iron and

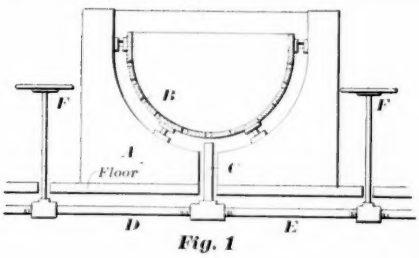


Fig. 1

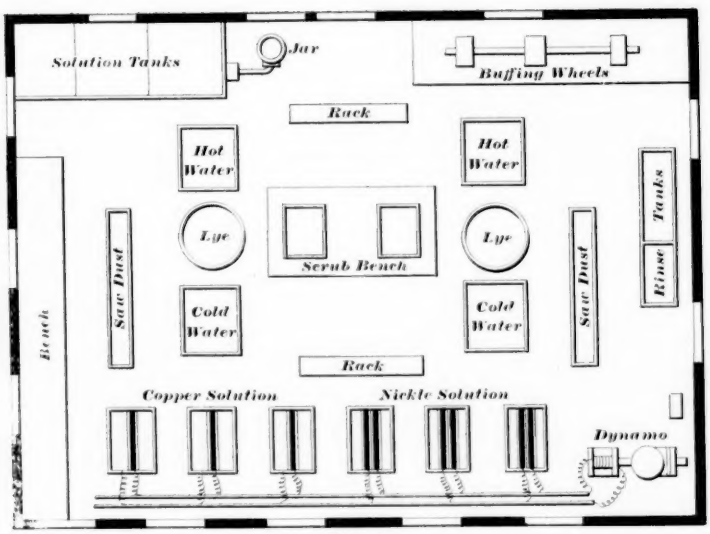


Fig. 2

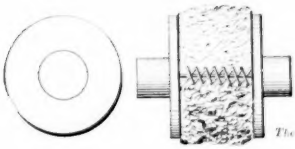


Fig. 3

Fig. 4

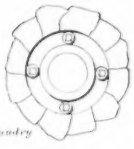


Fig. 5

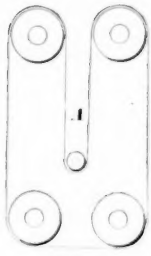


Fig. 6

show through the nickle, a copper base is applied, previous to which the pieces are wired and suspended in a lye solution in the above mentioned solution tanks. The grease and all foreign substance are thus removed. Next the castings are taken to the scrub bench where they are alternately treated with powdered pumice stone and brushes, and baths in cold water, until thoroughly cleaned.

A bath in a solution of oil of vitriol will now remove any traces of oxide, which, followed by another rinsing off in cold water, prepares the castings for the copper plating. The arrangement of the copper and nickle tanks is shown in the plan. An ample copper deposit will usually form in 15 minutes, depending upon the power of the electrical current and the thickness of coating required. After this, the nickle may be

applied at once, or if a pretty good job is desired, the pieces can be dried in saw dust and given another "coloring" treatment on buff wheels with snowflake powder, etc. If the latter is done, the castings require more rinsing in cold water to efface the rouge, and are then placed in the nickle solution. Double sulphate of nickle and ammonia (nickle salts) is used mostly, but can be made from carbonates or chlorides if wished. The solution should register about 7° Beaume Hydrometer and be kept in a temperature of about 60° F. during the plating operation. About 15 ounces of salts to a gallon of water makes a good nickle solution. A liberal anode surface is recommended for stove ornament plating. A strong and reliable dynamo is also an important factor in this type of nickle work. About 40 minutes' time in the nickle solution should answer.

FINISHING THE CASTINGS.

After plating the castings they are rinsed off in cold water and submerged in luke warm water, followed by turning them in a wire covered cylinder, the contact with air drying the surfaces in a desirable manner. The cylinder should revolve so fast that the castings will be held motionless against the sides. "Buffing" is the final operation and is accomplished in several ways, among the important of which are wool, cloth and belt systems as shown in figures 3 to 6. In the former is the type of wood wheel used, turned from close grained stock, balanced and smoothed for a wool fleece cover, as in fig. 4. The fleece should be laced on, as tacks often work loose and scratch the work. In fig. 5 is a cloth wheel made by having flanges on a hub, and these flanges close up on the cloth as shown. In fig. 6 is the belt idea, consisting of running a leather, fleece, canvas or other kind of belt over the system of pulleys as shown, and by holding the article to be polished at A, two sides are operated upon at same time. After the finishing buffing is done the castings are complete and ready for the market.

It Gives Results.

We are well pleased with the benefits derived from THE FOUNDRY.

JOHN S. HAM,
Manager Covington Machine Co.,
Covington, Va.

Making Cores.

By ROBERT GRIMSHAW, Dresden, Germany.

It seems strange that in iron-founding—an art which we Americans claim to have developed to a greater extent than any other people—there are lines in which the continental Europeans, notably the Germans, are more advanced in their practice than we are. Not only this, but in the very item of labor-saving, where we should be supposed to excel, we can, perhaps, take a lesson from Germany, which although just now a busy country, is still a land of cheap labor.

One item is our clinging to the core-box, and to wound-center cores.

The use of the core-box as such has the disadvantages of cost in construction of the box and its maintenance in store (with attendant items of insurance, etc.); of expense in ramming up the core; and of time and money wasted in finding the box in the store room and bringing it to the foundry. This is especially the case when, as we usually find it, the general run of cores about the foundry is plain parallel work (usually cylindrical). Where large quantities of pipe are cast, various standard lengths, of and of not slightly varying inside diameters (and this is usually the case where these different weights are listed, and these perhaps have to be "skinned" or shaved down or thickened up) core-boxes are out of the question for the long work, and the wrapped one, made of hay, straw, "excelsior," or other porous, fibrous material, with the sweetly smelling "smear" as an outer coating, does not give either smooth or uniform work.

Where the work of the foundry is manufacturing and not jobbing, there arises the necessity of making cores of uniform size, cheaply, as the occasion comes up, instead of keeping in stock a large assortment of diameters and lengths that may not be called for for years, and the very multitude and variety of which prevents easy finding—of making the cores right on sight as fast as needed. For jobbing, stock cores are not so available as in a manufacturing business.

In the matter of making cores quickly and cheaply many of the German foundries are far ahead of us; and no one but the Glasgow men (whom may the Old Harry confound) can touch them.

The method in large part adopted is the abandonment of the wrapped core and the almost exclusive use of sand-cores. The method of manufacture of these latter is most simple, and adaptable to the widest range of work. For the sake of convenience in description I shall divide the classes of cores made into the following:

I. Parallel in lengthwise section.

II. Shouldered or flanged.

For one and all, the machine is the same. There is a table having in its center a hole of about two inches greater diameter than the largest core to be made. Under this fasten with a bayonet joint any one of a number of pipe-like core-molds; each fitted with a plunger disk about an inch thick. This is thrust up from below by a guided plunger stem, bearing a rack engaging with a pinion on a horizontal shaft, on which is a hand-wheel, bearing graduations to show the position of the plunger.

To make a solid parallel core of circular cross-section, one of the circular core-molds is put in place and oiled internally; the plunger set by the wheel at the right depth from the table top; the sand lightly rammed in from above, squared off with a "strike," to the level of the table, and the wheel rotated so as to shove the core up. It will be found of proper diameter and length, and good finish, and may be rammed up as hard as desired.

If instead of the full length or one short length, a number of short cores are desired, the plunger is made to shove out the desired length, which is cut off with a wire at the table-level, and so on.

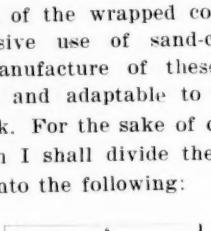


Fig. 1

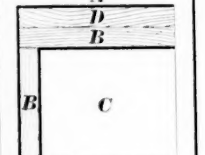


Fig. 2

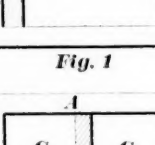
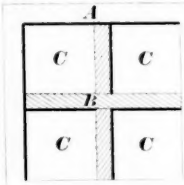


Fig. 3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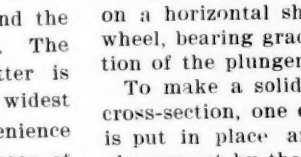

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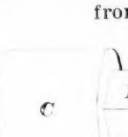


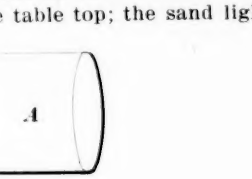


Fig. 8. "Dummy" for X work with unequal arms.

Fig. 6. Pieced up-Core.

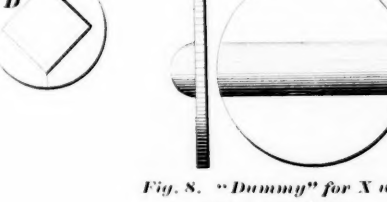
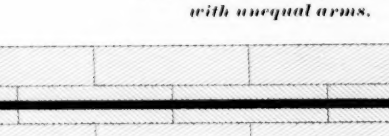


Fig. 7



Where a core-rod is desired it is set vertically in the center of the mold, and centered by a spider of wire, wood, or iron; the sand being rammed around it. Similarly, a large wooden center may be set in the core-mold, and rammed around, and then withdrawn so as to leave a hollow core, which may be cut into lengths with the wire as pushed out, if desired. A core-iron wrapped with straw-rope, excelsior, or other material, may, if so wished, be set in the mold for a large core.

For parallel cores of non-circular cross-section (usually square) there are molds or core-tubes of square cross-section. For square cores, either solid or hollow, the process is exactly as for those of circular cross-section; and, of course, these cores may have a central iron or tube, or a straw-rope or excelsior center.

Where rectangular cores of other than even "four square" cross section are needed, "liners" of plain, smooth board are set in the rectangular core-mold so as to pack it out to the desired form and area; thus, A (Fig. 1) representing the upper flange of the core-mold; B, B, inch boards, and C the clear space left for ramming (here, 6x7 inches in an 8x8 inch mold.

To make several small rectangular cores of one size at once, there is inserted into one of the large molds, of appropriate size, a partition-piece, as in Fig. 2, in which A is the mold-flange, which shows flush with the table-top, B the partition piece and C, C, C, C four clear spaces left for ramming. To cut these cores to lengths, withdraw the piece B before pushing out the core. The piece B is of the maximum length of core that the machines will make; if it projects above the table in making a shorter core, no matter.

Where a very slender, delicate core is to be made, which it is desirable to have quite porous, this can be effected quite simply. Say it is a half-inch round core. Saw a gas pipe (or better yet a smooth brass pipe) of half-inch internal diameter, in half lengthwise, with as fine a kerf as practicable. Set this in the smallest core-mold, packing out between it and the mold-sides with strips of wood the full length of the pipe. Ram it up; push out pipe, packing and core all together; then remove the pipe-halves from the core, when it is ready for use. If great accuracy in diameter is desired, the brass or iron pipe sawed in half may be a trifle too large, and then closed up on a mandrel, so that its new internal diameter, with the two kerfs removed, is exactly that required for the core.

To make a core shouldered at one end, as Fig. 3, choose a mold of the proper diameter and lay on the plunger a ring (as of wood) as wide and thick as the shoulder. To put a shoulder on the upper end also prepare a ring of the required dimensions, for the upper shoulder; if the core is small, use this ring as the rammer and keep on ramming until this ring lies flush with the table. If the core is large, nail on the ring three ears as shown in Fig 4, to hold it flush with the table; and ram all down until the ring lies properly flush and when removed shows a flat perfect upper surface; then ram inside the ring.

To make a core with central portion of less diameter than the ends, prepare a ring, in halves, to correspond with this neck (which may if desired be of any other section than circular, as shown in Fig. 5). If A is the under part, set the plunger so as to make this cylindrical part (it may be shouldered if desired) of the proper length; drop back the plunger and set in the halved ring D; ram in to make B and C; then push out all together and remove D; also the under ring if there be one.

Where cores are needed, of greater length than the plunger will permit making in one piece, sections may be made and pasted together if short and small. Larger sections may be made hollow and doweled together (if no core-iron or pipe is used) by cores of the same diameter as the central hole. (See Fig. 6.)

Where large quantities of cores with diminished central portions are needed, or where only one is called for, of very complicated outline, then a square or cylindrical box is made, split in half lengthwise, and inserted in the core-mold as a holder; box and core being pushed out together.

Where an X core is needed, with long circular arms of equal diameter, the two longest arms are made separately, a piece having first been turned up, such as is seen in Fig.

7, and laid on the plunger, flat side down. This represents half of the through-piece, which is made in one piece of full length, and will then be found to fit perfectly into the ends of the arms.

For a 90° X core in which one pair of arms is of smaller diameter than the other, the dummy for the small arms is a disk of the diameter of the greater ones, on which is tacked a semi-cylinder with rounded ends, corresponding with the small arms (see Fig. 8); and the thickness of the disk must be allowed for on the plunger-scale.

For acute X and Y and three-arm pipe cores, the core-iron or core-pipe must be made with branches at the proper places and angles, and then the branches of the core can very readily be attached.

merciful to his scale. The rail A has across each end a bar of iron about 1 1-2 by 2 inches to distribute the load equally on the four corners of the platform. In the middle of the rail is cut a keyway into which is fitted a hardened steel pivot shown in Fig. 2. Across the under side of the scale frame is a bar F with a hole at each end as shown in Fig. 1. The loops C and D pass through these holes, D being made fast and C being drawn down by the hand wheel G. The bearing point of each loop should be lined with steel, brought to an edge and hardened. Arranged as shown, only half the load comes on the hand wheel G which should, however,

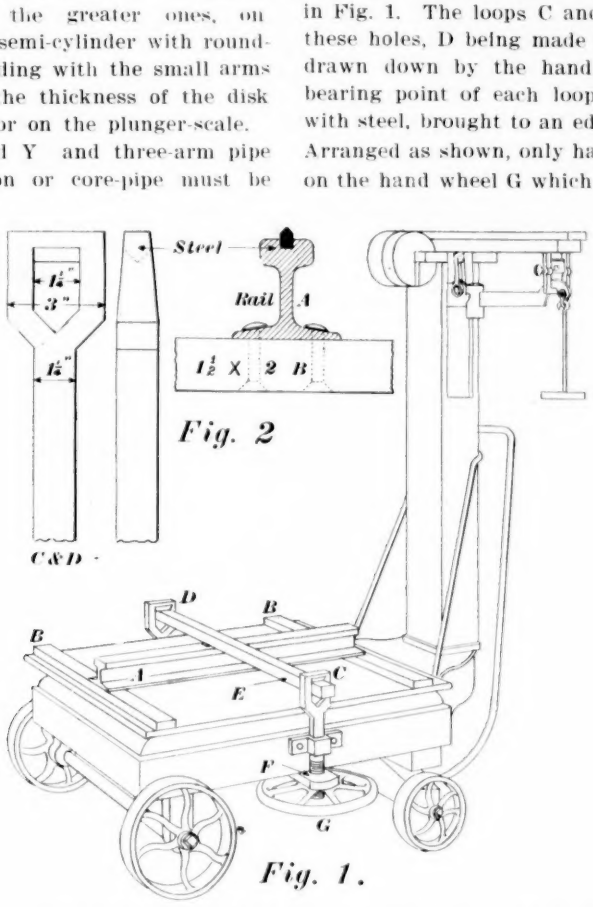


Fig. 2

Fig. 1.

A Home-Made Testing Machine.

The cut shows a simple means by which any foundryman may easily convert a platform scale into a machine for testing the transverse strength of cast iron. The scale should be of suitable capacity, at least twice as great as the strength of the specimen, as the shock of breaking the sample is very hard on the levers, and a merciful man is

be of good size. The brake wheel on a freight car is a good pattern.

The test specimen E should be exactly one inch square and as long as may be needed to take a bearing in the loops C and D, which will depend upon the width of the scale. Of course the greater the distance apart, the less power will be required to break the specimen. The tables usually give the tests for specimens of 1 square inch section and 1 foot in length, but tests of specimens of any length may be reduced to this standard by multiplying the breaking strain by the

length in feet. (Haswell.) Example; a specimen 30 inches long breaks with a load of 1,000 pounds, hence 1,000 times 2.5 equals 2,500 pounds which is the breaking strain of the same iron 1 inch square and 1 foot long. For comparative tests, however, one length is as good as another, provided this length is always the same. This machine will be found of great service in testing different mixtures of iron, or castings from different heats, or in experimenting upon different mixtures, for those who are most skilled do not hesitate to admit that any predictions regarding a new material, or the effects of a new process upon an old one are hazardous in the extreme and should be received with the greatest caution. If you are building machines from castings bought from a neighboring foundry, it is only fair that you should occasionally be furnished with a test bar, since the strength and durability of your product and much of your reputation depends upon the quality of the material which you use.

It is said that "the Brooklyn Bridge was carried across the river on the point of a pencil." Samples of all of the material, iron steel, stone and cement were tested for strength and a generous margin added for safety, and the computations made upon this basis. Thus, and thus only, can the engineer acquire and inspire confidence in the structures that he plans, and by a knowledge superior to that of his competitors exhibit such a fitness of design as shall ensure success.—W. H. Sargent in "Machinery."

Foundry Management.

By J. P. PERO.

The June issue of THE FOUNDRY in its report of the proceedings of the American Foundrymen's Convention, furnishes food for considerable thought on several important questions, which for some time have confronted the foundry interests of this country. Among other suggestions in the address by President Schumann I quote the following as of vital importance to foundry interests:

(a) "The cultivation and maintenance of knowledge and skill on the part of those practising our art, is a question paramount in importance to any that may come before us."

(b) "The adoption of a wise and uniform system of apprenticeship is a necessity generally admitted, and it should receive your careful consideration and action."

(c) "Equally important is the adoption of methods that will promote intimate and amicable relations between the employer and employe. The golden rule as a guide will readily suggest practical and effective means for bringing about beneficial results."

And, again, the Committee on Defense, through the chairman, W. H. Pfahler, presented a report from which I quote the following, to assist in establishing a connection between the conditions confronting us and what I believe to be the prime cause of these conditions:

(d) "It is one of the commonly accepted ideas of the times that the average employer is not only utterly indifferent to the welfare of those in his employ, but that he is constantly seeking new methods for enriching himself at their expense," etc.

(e) "To maintain what they consider their just position, workingmen, especially in our foundries, have long maintained one or more organizations by the aid of which they have frequently conducted protracted strikes," etc.

(f) "We all know that the greatest element of cost in manufacturing is the labor account. If all manufacturers were on an equal basis as regards the main cost of their product, how much would it lessen the strain of that awful competition that is sapping the life of our business, tending to increase the commercial depression and retarding the return of prosperity."

That these conditions have for some time existed is an unquestionable fact; that they still exist is proved by the fact that the greatest foundry organization of the country considers them sufficiently important to attempt the application of means to remedy them.

These conditions are an effect; there can be no effect without a cause; often many slight causes culminate in one grand effect. In other instances one or more principal causes breed others of minor importance, all combined make the effect.

Speaking from an experience of over 25 years in the different positions in foundry life, from apprenticeship to manager, it is my firm belief that there is one principal cause which has bred many others and

which in combination with others is responsible for the effect, the present conditions in foundry business. This principal cause, I believe to be the management, or rather the mis-management, of many of our foundries. I do not wish to be understood as believing that all or a great proportion of foundries are poorly managed, we all know such is not the case, but as the grain of salt leavens the whole loaf, so does the mismanagement of a few foundries affect the whole foundry system, in the matter of apprentices, dissatisfaction of labor, and keenness of competition.

Foundrymen in all parts of the country will readily admit that each has in his own section one or more competitors whose competition he fears, not because the competition is legitimate, but because the competitor, in his ignorance of the practical points of the business, stoops to methods that produce the very effects pointed out for the consideration of the late convention. Let us consider to what extent mismanagement applies to the conditions referred to in the quotations from the addresses of President Schumann and Chairman Pfahler. In presenting this view of the case I intend to be strictly fair and impartial and will present no statement that cannot be verified, simply give a statement of facts which I hope may lead those interested to extend their investigations in a direction that seems to have been overlooked in the past.

The first suggestion quoted from President Schumann's address (a) is already being carried out in the discussions and exchange of views at the foundry conventions, and through the columns of THE FOUNDRY and other mechanical papers, as well as in the published treatises on founding by West, Bolland and others.

The second quotation (b) is a wise suggestion and is made necessary to a great extent by the avarice of many so-called managers, who in their crazy desire to get out work at low prices, hire men as apprentices, at apprentice wages, and as soon as they are sufficiently skilful to expect or demand wages nearly on a par with the wages of the poorest kind of a molder, they are turned out to prey on the foundrymen of the country and their places filled with other victims.

This practice, more than any other one cause, is responsible for the great number of incompetent molders floating around the country, a source of trouble to the foundryman in his own shop, and worse, if possible, in the shop of an unprincipled competitor.

I fully believe it is this system of mismanagement that is directly responsible for the greater part of the ills of the present apprentice system (?)

Quotation (c) is to my mind one of the most important in the list, and goes far to substantiate my claim, that mismanagement is the principal cause of the ills that afflict the foundry business to-day; for, while under the best managed foundries dissatisfaction often exists and strikes sometimes occur, yet the percentage in such cases is small. Invariably the cause of these troubles may be easily traced to the oppression of the mismanager.

Now to consider Mr. Pfahler's report: In the first quotation (d) I would suggest that the language be modified so as to read, at least as far as it applies to the foundry: It is one of the commonly accepted ideas in some of our shops that the employer is not only utterly indifferent, etc.; and there is excellent ground for the presence of those ideas, as all foundrymen, molders, foremen and proprietors know.

Quotation (e) touches upon the organizations commonly termed the Union and Brotherhood. What has made possible the existence of these organizations? Surely not the honest and just attitude of employer toward employe.

I believe the mis-manager has done more than any other factor to make the unions not only a possibility but an actual necessity.

In expressing this view I am not talking for effect, I am simply expressing an honest conviction based on observation and experience, and while I do not sanction all union practices, in fact never was a member of either organization, I firmly believe that in many instances they are absolute necessities, and as a whole are performing their share of the work in trying to drive out this curse of unbusinesslike competition.

(f) There are many things that enter into the cost of production, many conditions that vary in different localities, but when aggregated or taken as a whole, it is generally found that the advantage of some particular firm or locality in any of the items of the

cost of production, is offset by an advantage in some items of cost in some other firm or locality. For instance: Large firms with a large working capital have an advantage over small firms in buying material, while the small firm may entirely offset this advantage by being able to figure much less for expense of non-productive help officers' salaries, etc.

The cost of production may be summed up under the following headings: Cost of material, cost of labor, cost of maintenance of plant and non-productive expense or cost of superintendence and office expenses. In many cases cost of delivery is a very important factor in cost of castings delivered at a given point, but even this item is sometimes offset by an advantage in some of the other factors of cost.

I fully believe that to-day many foundries are not half managed; perhaps it would be better to modify this statement and say, rather, that many foundries are managed on false business principles, and it is a conundrum to me how many foundries with whose methods I am more or less familiar manage to continue in business. The only reason I can give for their continuing is this: under the present business conditions there are many men who must have work at any price; these firms take advantage of this fact and figure the cost of labor very low, because they pay very small wages, and compensate the men for small wages by giving proportionately large days' work. Such firms as this, and there are many of them, are a thorn in the side not only of the molder but of reputable firms who are willing to pay living wages for an honest day's work.

Probably one of the greatest causes of low prices, is in many instances the incompetence of the men who "drum up trade" for the foundries, this is more particularly true of large firms where the traveling man is some bright fellow who owes his position to the amount of stock owned by his friends, more than to his ability to estimate cost of production in the foundry. He may be and generally is a bright, smart fellow of good appearance, a ready talker and good at making figures, but he lacks the practical knowledge, without which his figures are not reliable. He may know just the cost per pound of the different mixtures of iron, the percentage to be added for non-productive labor, freight, maintenance of plant and all the small details of cost except the most important, viz: the cost of productive labor, that is, the cost of the labor of the molder and, perhaps, the coremaker. Imagine a man looking for a contract or a small job on castings who cannot form an idea of the number of castings a man can make in a day or a week, who don't know the amount of time spent by the coremaker on the same work; who don't know whether the casting can be made by the average molder or whether it will require the services of the highest-priced man in the shop, who don't know whether the job will require new flasks or entail considerable expense in adapting old flasks to the job, who is not sufficiently practical to appreciate the difficulty or the simplicity of a casting in the molding, in other words, the liability of loss.

Do you think such a man competent to make a fair price for castings; perhaps you don't believe there are such people in the business, but there are; this is a strong statement, I am aware, but I know more than one such manager or drummer or anything you want to call him.

How do they get along? They try to learn what some other firm furnishes castings for and then underbid just enough to get the job. Let me illustrate: Some time since there was a contract to be awarded, there were twelve firms bidding for the contract, among the bidders was a firm who secured the contract the previous year; the bids ranged from 1¾ to 2¾c per lb.; tne price paid the previous year was 1.8c per lb.; the contract was awarded to the 1¾c bidder; the bid of the firm who had furnished the castings the previous year at 1 8-10c was 2 1-5c when the bids were opened.

The bidders present were curious to know how the successful bidder had made his bid so low; he told them "the price last year was 1 8-10c per lb. and I found that allowing for the difference in shipping cost, I could make the castings for 1¾c and get the same price that my competitor did last year." When he learned that his competitor's price, after an experience of one season, was increased from 1 8-10c to 2 1-5c, his jaw dropped; but he had a forfeit posted and he had to make the best of it; his only hope was in getting it out of the help.

Another case: A drummer for a foundry heard of a contract to be awarded, so he looked over the drawings and made a bid; the contract was awarded him and a time forfeit posted; the firm who secured the contract waited until nearly time for the work to be delivered and sent to the other party for the patterns, at the same time notifying them that unless the patterns were sent at once, the foundry firm would not pay forfeit for neglect to deliver the castings at time agreed. In the correspondence that followed, it transpired that the drummer had contracted to furnish castings which were to be swept up in "loam," and for which the drawings were in the foundry office; the foundry foreman was called into the conference that followed and learned for the first time the particulars of the contract, of which he had heard and for which he was waiting to see the patterns; the contract was filled, although it necessitated some changes in the foundry oven; but that firm would have made a much better showing that year if some other firm had secured that particular job.

These cases are not imaginary, one of them came under my personal notice, the other was told me by the foreman of the foundry doing the work.

What do such cases mean? Simply this: as a friend told me recently; this friend is foreman of a foundry afflicted with a "hustler" who "picks up" the work. The boss gets the work, the foreman stands over the men with a shot-gun and gets the work out.

I don't wish to convey the impression that this is a common practice among foundry firms, but I do believe there are too many firms doing business in this manner, and they not only injure honest, able competitors, but they are in many instances making the life of the molder anything but a happy one, for in most instances the molder stands the brunt of this battle of fierce competition, or, as a molder recently tersely expressed it, "We have to put up with it at present, but when business reaches its normal condition I know several firms that will find it hard to keep help." This molder works in a shop that is changing foremen at the rate of four per year and are making castings at very low prices. On the other hand, there is a competition in which managerial ability enables firms to successfully furnish castings at low prices. I recall a case in which a large contract for small castings was awarded, the contract to cover a period of a year. This contract had been awarded each year for several years to a foundry located within half a mile of the shop in which the castings were used, until a firm nearly 100 miles away secured the contract at a lower figure than had previously been paid. The firm that had made them for several years could not understand how the successful competitor could furnish the castings and ship them 100 miles at the price paid, but it was done at a profit by a greater managerial ability; for instance, one of the greatest items of the contract was a casting 6 inches diameter, circular in shape, practically a plate pulley with a face 1¼ or 1½ inches. The successful bidder had carefully looked into the cost of molding and found that by making a snap flask almost triangular in shape, with an area of about 240 square inches, he could get three castings in a flask. The other firm had for years been making two castings in a flask with an area of 198 square inches.

The cost of molding in the case of the triangular flask may have been a trifle greater, as the flask was 16 per cent larger than the other, but the increase of production was 50 per cent, a very noticeable difference, as these were light castings and the cost of labor was a very important factor in the ultimate cost of the castings.

This is an instance of honest competition, one in which skill in foundry management enabled one firm to make castings at a lower price than another and at a fair profit, without resorting to the tactics of the poor manager, "get it out of the help."

The firm mentioned above as being the successful one, have a very accurate system by which they can quickly learn the cost of any contract they have filled in the past; as their business is a very extensive one, embracing nearly all classes of work, they are enabled, with the assistance of their system, to easily obtain a fair estimate of the cost of nearly any class of castings; the advantage of such a system is obvious. It has always seemed to me that the manager is the key to success or failure in the modern foundry. In making this statement, I fully realize the value of a good foreman, good help and good facilities and wish to

emphasize the fact that a good manager invariably secures a good foreman and good help and as far as possible good facilities. I have known many good managers who were not practical men, but I attribute their success to their good judgment in having associated with them good men in the subordinate positions. In a large concern, doing a large volume of business, such a system of management is thoroughly practical, as the expense of maintaining such a position is proportionately small when charged against a great output and is often more than compensated for by his ability as a financier. I know several foundry firms whose managers are really a constant source of expense for which there is no adequate return, and I have often wondered that these firms did not abolish the position of manager and substitute an assistant foremanship in the foundry, by so doing give the foreman time to look up work, buy supplies and attend to the practical duties of the manager, while the financial duties might be performed by some of the other officers. Certainly a competent foreman is better able to estimate the cost of labor on work in his line of business than a non-practical man and the office can readily furnish cost of all other items entering into the ultimate cost of the work. I don't mean by this to insinuate that the foundry foreman of to-day isn't able to do all the figuring necessary in getting cost of work (that argument so commonly used a quarter of a century ago now falls flat, thanks to the different trade journals devoting more or less of their space to foundry interests and thanks to the foundrymen who, by educating themselves in all the details of their profession, have done so much to effectually eradicate this slur), but that the cost, outside of actual labor, can be more readily ascertained in the office than in the foundry and not divert the attention of the foreman from the more important duties in the practical part of his work.

How many managers are as competent to buy supplies as the foreman? Not many; true, the foreman doesn't have time to keep posted on prices, but if buying supplies was one of his duties, he would find it very easy, with the assistance of the office, to be thoroughly acquainted with the latest market reports. And what a difference there would be in the supplies purchased! Have you ever had any experience in a shop where the foundrymen knew nothing of the supplies until they reached the foundry? Have you ever seen the manager come into the foundry with a sample of flux which would entirely do away with dirty castings? Have you ever seen a silver lead sent to the foundry that "is considerably cheaper than the last but will do just as good work?" Have you ever had the fellow who could save half the fuel in melting, come in and spoil a heat or two for you? Have you ever had a molding machine unloaded on the shop floor and have the manager say, there's a machine that can be operated by a laborer and after he gets acquainted with it he can do as much work as two or three molders. Have you ever had any experience with the fellow who could throw some substance (the formula of which was a profound secret), into the cupola or a ladle to produce a fine-grained, soft iron from any kind of old scrap? Have you ever had 50 or 100 tons of half-burnt or heavy marine scrap dumped into the yard and been told it was just what you wanted to make castings for which it was entirely unfit? Have you ever had the manager come in with a mixture of the different kinds of pig iron in the yard, to which has been added some strange brand, which predominated to an alarming extent in the mixture, and by the mixture or rather by the prominent factor in the mixture you knew which iron salesman had caught the ear of the manager last?

Perhaps you have not had this experience. I should hope none of us would be afflicted with this whole list of tribulations, but you recognize them all, don't you? You have met some of them and in swapping experiences with some other craftsman you have heard of the whole list.

Now these are actual occurrences, not freaks of imagination.

No foundryman is more willing than I to adopt a suggestion, a method or a material that will improve or lessen the cost of castings, and with all due respect to the men who sell the fluxes, facings, melting secrets, molding machines, scrap iron and pig iron, don't you really know that in some instances they have caused you to at least think "cuss words" by leading the manager to expect you to perform miracles to substantiate claims they have made for their different

goods, and haven't you often wondered that any sensible man could be so gullible as to believe many of the fairy tales the manager has told you of the results obtained by adopting this or that article or method in foundry practice, or do you believe it possible to induce practical men to swallow all the expense reducing pills enumerated above?

These statements are not intended as a reflection on traveling salesmen, for we all recognize their usefulness and have the highest regard for many of them. I simply wish to show how often a clever salesman with a plausible story of reduction in expenses or improvement in quality of castings, may dupe a non-practical man in matters which the practical foundryman knows from long experience are practically impossible. I am aware that many of the readers of THE FOUNDRY will disagree with the views here expressed, and I fully believe many of the practical foundrymen will heartily indorse them and find in this article a narrative of their own experiences.

Lighting Vents.

BY R. D MOORE.

In reply to friend West in the convention number of THE FOUNDRY, I would say that it was a cinder bed that he treated of first in that article, and I always had a suspicion that a gas explosion might run back into the cavities and rip up the mold. I regard either system as safe if the molder perfectly understands how to handle it, but if not, smothering is the safest.

During my apprenticeship a good loam molder cast many flat and round bottom kettles with wet hay smothering, successfully.

During the twenty years of my connection with the Niles & Co. shop we cast many kettles without a blow up by making a trench to the top of bank, piling a barrel of shavings in the center, and leading a train of shavings to the edge, for lighting.

We fired them with the usual hot rod and let the flame reach the center pile before pouring; that big flame reaches the top, igniting the first gas, when no explosion can occur.

About forty years ago a kettle was thrown out of the pit, in this city, against all that weight and rammed sand, immediately after pouring, but that was the "other fellow." They had blundered in lighting the vent. My universal practice, in casting a countless number of engine cylinders, was to put shavings in the barrel and light before starting the pour.

The printers make many puzzles for molders out of foundry literature; a word was left out of the very paragraph which started this discussion in the January number.

In the Convention Number, page 129, I named a discovery that prevented scabbing. I named cylinder boiler heads, etc. The printer made me say cylinders, boiler heads, etc., two articles.

Mr. West has given us a very exhaustive treatment of this subject.

I cannot see how our views differ on these subjects, for in the article under discussion, on page 58, he says, "it is here sometimes best not to have the vent pipes lighted until the mold is full of iron."

Questions and Answers.

GAS ENGINES—THE BEST WAY TO MAKE ANDIRONS.

Are gas engines suitable for a foundry and machine shop requiring 16 horse-power and are they more economical than steam engines?

Which is the best way to make andirons with fast legs? E. F. CO.

MIXTURES USED IN MAKING AMMONIA PUMPS.

Will some of your readers please tell me the mixtures of iron employed for producing ammonia pumps and fittings? I find it difficult to keep the castings from leaking.

B. KNEPPER.

Tubal's Meditations.

The grain of an iron does not always reveal its utility, neither does the personal appearance always betoken an individual's ability.

The employer who will not furnish facilities for his molders should not expect frescoed ceilings with a whitewash brush.

The scrap pile is an item of expense, a page in the volume of experience, the torment of the careless, the guide and textbook of the observant, and the "might of been" of the employer.

A TECHNICAL JOURNAL DEVOTED TO FOUNDRY INTERESTS.

THE FOUNDRY

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JOHN A. PENTON,

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Trade Outlook.

One of the curiosities turned out by our ever changing, tariff tinkering government at its present session is an amendment offered by Senator Pettigrew, of South Dakota, imposing a duty of 45 per cent on plumbago. We have always preached that the best is the cheapest, and the best plumbago is not found in this country, consequently this bill cannot be said to be in the interest of protection to home industries. The effect of its passage would be to drive the foundryman to the use of inferior graphite and talc and to handicap him in a chance to turn out work in competition with other countries. As we are just now trying to make as favorable an impression as possible abroad, practical jokes of this kind become rather serious.

Thus far the month of June shows an increase in both inquiries and orders. Those who are in a position to judge, report that collections are far easier made than at any time within a twelve-month. There is but little inclination shown to bull prices, as the majority of producers seem to believe that the low level of values will ultimately result in a far better trade than could be secured by any temporary advance, which would be almost sure to retard consumption.

The curtailment of production has, in a degree, strengthened the prices of pig iron or at least prevented them from sinking lower. Exports of southern irons continue, and is, in fact, stimulated by a recent rise in the price of English irons.

Reports indicate a greater activity among eastern foundries than has been the case for some time. While none of them have secured fancy prices, a portion has evidently learned to produce castings at a less cost than formerly.

The Scrap Heap.

The Journal of the Iron Molders' Union comes right straight at us because of something we said in our May issue about foundry employes not evidencing more ambition in the effort to improve themselves intellectually and mechanically and also because of something in the same article about a standard rates of wages.

* * *

The Journal's article rather inclines to a justification of the very evident indifference

displayed by the average molder when it comes to matters of self-improvement.

It is lamentably too true that the aforesaid gentleman has too often no ambition that goes farther into the future than Saturday night or the next pay day. However we know of no more conspicuous example of what can be successfully done in this line when an earnest effort of selfhelp is made than that set by the accomplished editor of this same Iron Molders' Journal.

* * *

We venture to assert that if interviewed personally, he would readily concede that ignorance was one of the greatest drawbacks of the American workingman, and not that alone, but the absence of an earnest sincere desire for better conditions is what renders it so difficult for workers in lines similar to those filled by the editor of the Journal to make possible many of the reforms that would otherwise be easy.

Ignorance of itself is bad enough, but to be ignorant of one's own ignorance or knowing it, to be satisfied to have it remain so, is always discouraging feeling to those who desire honestly the uplifting of mankind all along the line.

* * *

It is true, as pointed out by the Journal, that present conditions are such as to render it exceedingly difficult for a foundryman after doing a day's work to afterwards devote any time to self-improvement, but it is also true that the way is apt to appear to those who have a sufficiently strong determination. It has done so before and can again and a careful canvass of conditions as they exist in many foundries would furnish ample proof of the foregoing.

* * *

The very fact that a molder's or any other mechanic's time is so completely absorbed by his work and he is left so fatigued as a result therefrom, is only an additional reason why he should make the extra effort to improve himself, in order that he may be fitted for something more remunerative.

It has been done often before and will be often in the future, and those who show the greater amount of eagerness in this respect will be the prize winners every time.

Concerning the matter of standard rate of pay, much can also be written. There is too great a tendency on the part of the employers and employes to take advantage of the excuse offered by this same standard or "minimum" wage rate.

It is a question if it would not be greatly to the advantage of every employer to single out a few of his best men and increase their wages, if only ten or fifteen cents a day over the minimum. This would have the effect of greatly stimulating its recipient to increased care, thoughtfulness and effort and encourage others to try to prove themselves worthy of it.

Employes are apt to complain of this minimum wage scale, but the Journal misinterprets our remarks as meaning a reflection on the employe, when in reality it is the only method possible. This, as well as other abuses might, however, be greatly altered for the better, if the average molder would apply all his intelligence to the solving of the problems that confront him daily, besides doing all in his power to keep abreast of the times.

Defects in Iron Castings.

Suppose that we have a pattern in the sand, which is not very large or heavy. When the top part is rammed up and ready to be lifted, then the small vent wire is used all over the top part, passing through the sand till it reaches the pattern. The top part being then lifted off, a small channel is cut with a trowel all round the pattern and 2 or 3 inches from it; then the vent wire, bent so as to pass under the bottom of the pattern, is freely used round this channel, which is intended to connect all the vent holes. Branches are cut from this channel so as to lead all gases away clear of the top part. * * *

The last cause of blow-holes we will deal with is that due to the improper situation of risers. The riser is an outlet through which escape all the air and gases contained in the mold at the time of casting, and which are, of course, displaced as the melted iron runs in. The proper position of a riser is naturally the highest part of the casting, unless that is where the runner happens to be placed. Should there be several high points, then there should be a riser for each, or there

would be certain parts of the mold where air would be imprisoned without any means of escape.

(Abstract from a paper read before the Liverpool University College Engineering Society.)

We have often said in these columns that the average man finds it easier to discuss anybody's business but his own. The author of the above paper is an example of the class of people who are bringing foundry literature into disrepute. He would have far more cause to write a paper on "Defects" in his own mind than those existing in the foundry. When he advises us to let a vent wire reach the pattern he shows his own ignorance, as he also does when saying that "the riser is an outlet through which escape all the air and gases contained in the mold." If this is the purpose for which the riser is used, where is the necessity for venting? It might also be interesting to have it explained how the thousands of molds are filled that are neither provided with vents or risers.

There is nothing surprising about the "floating" of such misleading statements before an audience unacquainted with the first principles upon which a mold is made. But it is peculiar to find such "wild cat" assertions reprinted by respectable journals, who take especial pride in their authority on mechanical questions. When it is remembered that these papers offered a very harsh criticism to a well known writer on foundry subjects, who chanced to slightly overreach himself, the fact of their printing a lot of trash that is, to say the least, useless if not harmful, becomes the more remarkable.

For Their Own Good.

The employes of the Minnesota Stove Co., at Shakopee, Minn., and the different members of the firm, have organized a "Foundry" Club, which holds regular weekly meetings, when all assemble on equal terms and discuss any questions that present themselves, whether these relate to mechanical or social features of conducting a shop.

In this way any grievance that may develop is freely discussed and remedies applied, thus nipping in the bud all causes of complaint that usually increase with time. Much of the trouble occurring in shops could be avoided if both parties would in this manner become acquainted with each other's condition. The employer familiarizing himself with the obstacles under which the men labor and the employes gaining an insight into the way business is carried on, there will be less liability for hasty and harsh action on the part of either party.

The Iron Trade Abroad.

The iron trade is generally relied upon as being a fairly true barometer of business conditions throughout the world especially so in the manufacturing countries of Europe and the United States. The monthly report of the Friendly Society of Iron Founders of England, Ireland and Wales becomes, therefore, the more interesting since it reflects in a measure the degree of prosperity existing in these countries. After calling attention to the decrease of those receiving donative benefit and to a number of shops where an increase of wages or a reduction in working hours has been effected, the report shows that out of advices received from 124 places, but one reports business actually dull and 76 consider trade very good, the balance classing between good, moderate and improving. In the matter of funds the Friendly Society has also made considerable progress during the year, the cash on hand amounting to $270,760, against $182,915 a year ago. When we contrast such bright figures against the somewhat faint outline of our own progress, we cannot help but congratulate our cousins upon something else besides the queen's jubilee.

Krank's Korner.

That labor disturbances are sometimes created by ridiculously small matters is attested by the recent refusal of the molders of the Channon Emery Stove Co. at Quincy, Ill., to continue work unless they were provided with ice water. The water of the Mississippi may not be the best, though a few miles further down the molders of St. Louis take something into their stomachs that is infinitely worse. We have contended before, in this column, that labor can be relied on to make all the demands it is thought possible to enforce and our position is undoubtedly justified. Instead of each contributing the mere fraction of a cent daily towards, what is practically a luxury, these

molders, who would never think of drinking ice water at their homes, insist upon securing it, as long as someone else pays the bill. It is a small matter to fight over, but it is little things like these that finally result in serious disputes between employer and employes.

* * *

If a man should walk into the office of the average foundry and offer to sell a gold brick for half price, he would undoubtedly be disposed of in short order. But let this same individual claim his ability to turn a pile of stove plate scrap into semi-steel, let him confidentially explain how the foundry business is going to be revolutionized by his methods and there are plenty of foundrymen who are anxious to secure a corner upon the process.

When sometime ago, Jacob Luippold was appointed receiver of the Hercules Metal and Smelting Co., of Buffalo, N. Y., and the court granted an order restraining Chas. T. Hennig from making further experiments, another bunco game was laid open for public inspection.

This company was organized during the latter part of last January by Christian C. Luippold, Charles T. Hennig and Jacob Luippold as a co-partnership to manufacture metal and steel goods of all descriptions from certain formulas known to Mr. Hennig.

Christian C. Luippold has begun suit in the Supreme Court to secure from Mr. Hennig an accounting, alleging that Mr. Hennig asserted that he was in possession of certain formulas for the manufacture of forgeable brass and self-hardening steel, which formulas Hennig agreed to write out and deposit in the vaults of the Buffalo Loan, Trust and Safe Deposit Company, in the name of the firm. It is further alleged that Hennig agreed to teach Jacob Luippold all the secrets of the manufacture and to mix all chemicals in his presence.

Mr. Luippold now alleges that Mr. Hennig did not deposit the formulas in the bank vaults, that he has refused to put them in writing, that he has neglected to instruct Jacob Luippold and that Hennig has broken the agreement by refusing to divulge the secret processes of manufacture.

He further charges that Mr. Hennig has manufactured a lot of useless material, which is of no commercial value, to such an extent that the firm has become insolvent. He also alleges that Mr. Hennig has no secret processes or formulas, and he is incensed because Mr. Hennig has demanded absolute control and possession of the plant.

We have but little sympathy for those who permit themselves to be robbed by sleek tongued metallurgists with secret formulas for revolutionizing the iron trade. Like the man who buys a ten dollar "genuine" bill for fifty cents, he is an abettor of fraud, and if he is caught financially in the schemes he has helped to prepare for others to fall into, he is receiving but his just dues.

* * *

Reports from Santiago, Chili, announce that the government stands ready to give anyone establishing a foundry there $125,000. As some of our foundrymen, who are temporarily disengaged may feel inclined to reach for this bonus, it may not be amiss to state that such offers usually have a string to them, by which they can be pulled back. There is but little use for the bonus where an actual demand exists for such enterprises. Suppose for a moment that the same offer should be made for establishing a foundry in Greenland, would anyone think of fostering a legitimate enterprise under the circumstances? The fact remains that industries do not thrive well under artificial stimulants and that a bonus can never give permanency to anything cultivated where no demand can possibly be created.

Are Foreign Recommendations Above Par.

A little more than two years ago the Scientific American published a short sketch of a new metal called "Ferrous Steel." This was a product made by Thomas Doherty, of Sarnia, Ont., from 60 per cent. of common scrap and 40 per cent. No. 2 pig iron, for which was claimed greater strength and ductility than had before been thought possible to obtain in cast iron. The peculiar qualities of the metal were said to be imparted by injecting steam through the tuyeres during the process of melting, resulting in superior castings, being produced from inferior iron by the absorption of new elements, created by the introduction of the steam. Besides permitting the use of a poor class of materials it was claimed that the process effected a saving of fully 10 per cent. in fuel and gave to the metal a greater fluidity than

the ordinary way of melting iron. With the keen competition existing between the American foundries what could be more natural than to expect the ready introduction of such a process calculated to effect a saving in more ways than one?

Instead of this Mr. Doherty has evidently been obliged to seek his laurels in a foreign country, although we are somewhat in doubt as to their passing as a legal tender on this side of the water, where the process has been previously tried and found wanting. The Doherty Process Company of Ridgway, Pa., has lately issued a small pamphlet embodying a report of tests made at the works of the Hamilton Iron Foundries and Engineering Works, of Liverpool, England, which resulted in the sale of the patent, it is said, for all countries except the United States and Canada for £100,000. As a preface it is stated that "in England where the cost of production is carefully figured and where tests of merit are most thorough, the Doherty Process has won." From this we infer that the author of the pamphlet is under the impression that the cost of production and test of merit are uncommon in this country. We doubt whether any English foundry has been subject to so close a figuring of the cost of production as has been the rule here for the past few years, and as for recognizing merit, there is no body of manufacturers more willing to take notice of real merit than the American Foundrymen. On every hand one improvement after another has entered the shop as fast as real merit has been shown, and if the Doherty Process has failed to secure an introduction here it has been because it has either failed to demonstrate its merit or is devoid of real value.

The following is taken from the published report of the test:

CUPOLA.

Diameter of shell, 3 feet 10 inches.

Diameter inside lining, 2 feet 4 inches.

(Note. The Cupola is lined to one diameter from hearth to charging door, and reduced afterwards.)

Height from hearth to charging door	17 ft. 7¾	ins.
Height from hearth to center of tuyeres	1 ft. 6	ins.
Diameter of tuyeres	4	ins.
Number of ditto	4	

BLOWER AND ENGINE.

(This is a combined engine and Root's blower (No. 5) by Thwaites & Co., of Bradford.)

Maximum pressure of blast	14 oz.
Maximum volume of do. per minute	4,000 cubic feet.
No. of revolutions per minute for 14 oz. of blast	180
Ditto for 10 oz. of blast	90
Diameter of steam cylinder	11 inches
Stroke of engine	10½ "

ORDINARY PROCESS.

Average loss on iron melted	6 per cent.
Average rate of melting per hour.	4 tons
Average consumption of coke per ton of iron melted	3.35 cwts.

The pressure of blast during this trial was 14 oz.

DOHERTY PROCESS.

Average loss on iron melted	2.7 per cent.
Average rate of melting per hr.	5 tons
Average consumption of coke per ton of iron melted	2.74 cwts.

The pressure of blast throughout the trial was reduced to 10 oz.

The first thing noticeable is the height of charging door, 17 feet 7¾ inches. This should favor economical melting. We have but few 28 inch cupolas here of such a height, although the matter of high charging doors has been brought to the attenton of the foundrymen on more than one occasion. Then a 9-inch lining in that size of cupola is also something unusual, and we regret that the diameter at the melting point is not given, as variations at this point result in giving the cupola a greater melting capacity. This becomes the more noticeable when the rate of melting is considered, four and five tons per hour, the ordinary rating of a cupola of this size by manufacturers being commonly from 2,500 to 4,000 pounds per hour.

One of the most curious exhibitions of foundry practice is furnished by the statement that with the ordinary process the speed of the blower was maintained at 180 revolutions per minute. As the blower (Root's No. 5) discharges 24 cubic feet of air per revolution we have the volume of air being forced through the tuyeres per hour as 259,200 feet, and melting four tons per hour leaves 64,800 cubic feet to each ton. As the

amount of air needed to melt a ton of cast iron is between 25,000 and 30,000 cubic feet we find that double the quantity actually needed was forced through the cupola. If too much air ever exerted any evil effects certainly here is a chance to make observations.

With the Doherty Process the amount of air required was reduced to 25,900 cubic feet per ton, which represents the average American practice. As for the ratio of fuel, which is raised from 1 to 5 65-67 to 1 to 7 41-137 it will be observed that the original ratio is a very low one, while hundreds of American foundrymen will show a better one, without any claims for a patent process than is exhibited by the Doherty process.

As Artemus Ward used to say, "Comparisons are odious." And in the present case especially so. An attempt is here made to contrast the results obtained against a very inferior management, as the figures themselves demonstrate. We are convinced that intelligent handling of the cupola in the present case would produce as good results as are credited to the Doherty process.

Testimonials from abroad have but little influence with practical men. An article possessing merit can secure these anywhere. Let the Doherty process guarantee a reduced cost of production, and it will have no trouble in obtaining American subscribers to testimonials.

Men of Note.

At the last convention of the American Foundrymen's Association, several changes were made among the vice-presidents, representing the different sections of the country. We present this month a brief biographical sketch of two of these, Mr. William E. Sessions, vice-president for the New England States, and Isaac W. Frank, who represents the interests of the Middle States in the same capacity.

WILLIAM E. SESSIONS.

William E. Sessions was born at Bristol, Conn., on February 18, 1857. He received a common school education in Bristol and then passed through a four years' course in Hartford High School and graduated there in 1876.

He then entered the employ of his father and brother, J. H. Sessions & Son, trunk hardware and wood-turning manufacturers of Bristol, and a year later became a co-partner in the said firm.

He remained with the firm of J. H. Sessions & Son only until April 1st, 1879, when a co-partnership was formed by his father and himself under the name of Sessions Foundry Co., succeeding the Bristol Foundry Co., for the purpose of carrying on the general foundry business. The business was a small one at this time, employing only fifteen or twenty workmen. He became the active manager of the said business and has continued as such ever since.

The business of this company steadily grew and many additions were made to their

works from time to time until in the spring of 1895 it was decided, in order to accommodate the increasing business, to build an entirely new, large, modern foundry plant, which was built and occupied in January, 1896. The business was organized into an incorporated company in July, 1896, by John H. Sessions, William E. Sessions and William T. Shepard, all of Bristol. Mr. William E. Sessions since that time has held the office of general manager and treasurer, his father, John H. Sessions, being president, and William T. Shepard, formerly manager of the Buffalo branch of Rogers, Brown & Co., the well-known pig iron merchants, being the secretary of the company.

Mr. Sessions comes from good stock, being a lineal descendant of Alexander Sessions, who came from England in 1639.

ISAAC W. FRANK.

Isaac W. Frank, vice-president of the American Foundrymen's Association for the Middle States, was born in Pittsburg, December 2, 1855. After receiving a preparatory education in the public schools and Western University of his native city, he took a full course in civil engineering, and graduated from the Rensselaer Polytechnical Institute,

of Troy, N. Y., in 1876. The following five years were spent in active work in the engineering field. In 1881 he entered the Lewis Foundry & Machine Co., as partner and engineer, continued in that connection until 1892, when the foundation of The Frank-Kneeland Machine Co. was laid, of which he is president and general manager.

A stitch in time saves nine, but a nail in the corner of a flask often saves a casting.

When a foreman has to watch his men all the time, he had better get new men, or the firm a new foreman.

The molder who attributes all his mistakes to "bad luck," had better take a course in legerdemain or astrology.

Cupola Practice—Melting and Controlling Mixtures of Iron.*

By JAMES A. BECKETT, Hoosick Falls, N. Y.

There is no single item of foundry practice to-day which is of so much interest to the practical foundryman as that which I have selected for the subject of this paper. From the revival of the art of casting iron in the early part of the sixteenth century, down to the present time, the practical melter and his employer have watched with ever-increasing interest the evolution of each theory which has been put forward, and the perfection of each improvement in furnace construction, which promised, even in the most remote degree, to enable them to produce more uniform results in the production of castings.

While the search for a solution of the difficulties which prevented the attainment of even a partial uniformity of results, was conducted upon the basis of a superficial knowledge of the phenomena resulting from faulty practice, practical success was well nigh an impossibility, and at best could only be attained by men of large experience and of more than average ability and intelligence, who were able in an imperfect way to grasp the situation and by carefully watching and thoughtfully considering every symptom of disorder, apply such remedies as experience suggested. How imperfect such practice was so far as it related to the matter of melting iron in the cupola, is best evidenced by the works of the early writers upon this subject, in which matters which are now well understood through the researches of the past twenty-five years are treated as a mystery; or, they are made the subject of ridiculous guesswork, and, in the latter case, some of the remedies given for troubles which are now known to result from the most flagrant violation of natural laws, are given in the form of a mysterious compound, under the name of a patent flux; a nostrum which was warranted by its discoverer, to soften iron for stove plate, to increase the depth of chill on car wheels and to make engine castings, close grained, soft and tough, no matter what kind of iron was used in making them. Then, in more recent times, the older foun-

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drymen will remember the advent of a class of men who pestered the foundry owner until he was induced to try their secret mixture of iron, a mixture which was, of course, only known to themselves, by the purchase of which the foundryman would be able to make so much better and cheaper castings than his neighbors that he would be able to control the entire foundry trade in his section.

It is needless to say that his expectations were never realized, and that, in some cases, it took several years to work off the last of that wonderful mixture. In those days, the professional melter was the most important figure in the foundry; but, as the real value of his work came to be fully understood, the need for his services disappeared, until today the professional melter is pretty much a picturesque memory, and his place is being filled by the man he looked down upon (from the scaffold)—the hard-working foundry foreman.

James A. Beckett, general superintendent of the entire manufacturing plant of the Walter A. Wood Mowing and Reaping Machine Co., at Hoosick Falls, N. Y., occupies a high position, which has been reached entirely by his own efforts. Let those who shout that a workingman has got no show follow the life of Mr. Beckett from the time he entered the foundry as an apprentice to the present, and it will be seen that loyalty and honesty coupled with ability has got a show, and always will have. Mr. Beckett's writings on foundry matters are well known to our readers. Being yet a young man, in the prime of life, his work has practically just begun.

The adoption of coke as a fuel in melting iron in the cupola was one of the first important improvements in cupola practice. While good anthracite coal is in some respects a purer fuel, there are limits to its use; it is only good when used in short heats; on account of the infusible character of the ash of this fuel it is practically impossible to even partially clean out the cupola while melting, as is frequently done with coke; so that, when melting with coal, the limit of the heat is the length of time it takes to produce a sufficient quantity of refuse matter to bung up the cupola. The use of coke made it possible to melt more iron in a given time and with less fuel, because from the peculiarity of its structure it could be more readily converted into gas. A belief that there should be a more perfect combustion of the gases, led to a number of experiments being made in this country and in Europe which resulted finally in the introduction of an additional supply of oxygen into the cupola at the melting zone, by means of an upper row of tuyeres, which, through the operation of well-known natural laws, makes the combustion of the gases more complete.

The saving in fuel and increased efficiency resulting from the adoption of the type of cupola which bears the name of the late Victor Colliau of this city, would, if there were no other considerations, entitle his name to a place upon the honor roll of the heroes of industry, whose peaceful victories are no less renowned than those of war.

For the purpose of this paper I shall take the Colliau Cupola, which was perfected in this city some twenty years ago, and in its various types and changes, has practically marked a new era in cupola practice, preferring to leave the newer and later systems of melting (which are yet more or less in the experimental stage) to the consideration of those, who, by reason of a greater familiarity with them, are better qualified to speak of their merits.

After several years' experience with the Colliau Cupola, in various sizes, I am led to believe that the best work can be done with a cupola having a six-foot shell, lined up to the door with two courses of good arch

fire brick, which will give a thickness of lining of 9 inches. Above the door one course of good arch fire brick 4½ inches thick will be sufficient, if properly laid and supported by suitable angle irons bolted to the shell, to sustain their weight when the lower lining is being repaired. They will last as long as the shell of the cupola lasts, provided that instead of the usual solid door, lined with bricks or clay, a door of wire screen is used which will keep the sparks from getting out on the charging floor at the end of the heat, and will admit the cool air to enter freely and cool the brick work in the upper part of the cupola.

The bricks used in the inner courses of the lining at the melting zone should be selected for their refractory qualities. Above the melting zone the bricks should be hard enough to withstand the wear and tear of the stock in passing down to the melting zone.

The size of a bed of coke for a cupola of the size given, which would have an inside diameter of 54 inches, must depend largely upon the kind of coke used, the kind of iron melted, the character of the work to be poured and the character of the blast used, whether it is obtained from a fan or from a pressure blower.

For light or medium sized heats the fan gives good results, and is largely used; but for larger heats and more economical working in my practice the positive pressure blower has given more satisfactory results. If the blast pipes are in good condition the number of cubic feet of air per minute which the blower is speeded to deliver must pass through the cupola, which makes it certain that as great a volume of air enters the cupola during the latter half of the heat when the pressure increases as there did in the beginning of the heat when there was less resistance to the entry of the blast.

For the purpose of this paper we will assume that the pressure blower is used, which is sufficiently large to deliver about 6,000 cubic feet of air per minute, which should give an average pressure of about twelve ounces. For ordinary medium sized castings the bed of fuel for a Colliau Cupola of the size given should be 1,800 pounds of good coke, which should have at least 10 per cent. of ash, and which should not exceed 1 per cent. in sulphur. This amount of fuel for the bed will make a safe starting point, which may afterward be changed by more careful work.

In this type of cupola it is not necessary to follow the old rule of making the first charge of iron three times the weight of the fuel in the bed; upon a bed of coke of the size given 6,000 pounds of iron may be charged. If sprues and scrap are used in this charge, they should be put in in such a manner that they will melt no faster than the pig iron; this will not tend to increase the speed of melting, but it will make more uniform castings than if the sprues or light scrap were charged directly upon the coke. This rule should be observed throughout the heat.

The second charge of coke should be 500 pounds, followed by 6,000 pounds of iron, in the same manner as before and so on to the end of the heat, making the last charge of coke 100 pounds less than the others or increasing the last charge of iron 1,000 pounds as the heats may vary from day to day. This will give a ratio of 1 of coke to 10 of iron, in a heat of 36 net tons, and the average speed of melting after the first iron is taken should be about 14 tons per hour. When a foundry is equipped with the most modern appliances for distributing the melted iron and particularly when running on a uniform product in which the castings are not too thin, the melter may gradually increase the amount of iron in each charge to 7,000 pounds, or he may vary the amounts of coke and iron after the bed in such a manner as in his judgment the working of his cupola demands, keeping the proportions 1 of coke to 14 of iron after the bed. This should be borne in mind as when the amount of fuel in the heat is reduced to its lowest safe limit it is seldom found that two cupolas will work exactly alike. The ratio for the charges last given would be 1 of coke to 12 of iron, in a heat of 55 net tons.

If it is found that a ratio of 1 of coke to 14 of iron, after the bed is sufficient for the work to be poured, the blast pressure can be increased to 13 ounces; the speed of melting will be increased and the iron will be better than if a lower pressure is maintained.

Those who have been content with the average ratio of 1 of coke to 7 or 8 of iron may be inclined to think that there would be but little prospect of success with the fuel ratio just given; but it is not by any means the limit of good practice in melting iron in this style of cupola, as it is based

upon the work of a foundry which makes castings, many of which are full of cores, and which range from an ounce to 125 pounds in weight, and where the melted iron has to be carried an average of 200 feet to where the lightest work is poured.

In this foundry a heat of 55 net tons of iron with the last fuel ratio given and a blast pressure of 12 ounces seldom takes more than three hours from the time the first iron is taken unless it is necessary to reduce the speed of melting near the end of the heat, when the molders are unable to pour the iron as fast as it melts.

The reason why I count from the time that the first iron is taken is because there is so much difference in the manner of starting the cupola in the different foundries doing the same kind of work; some prefer to light the fire early and let the bed get well started to burn before charging the first of the iron, and then, after the cupola is filled, it is allowed to burn until a few minutes before the iron is wanted, when the blast is put on; by this method the iron is melted very quickly after the blast is put on. Others light the fire with just enough coke on the wood to make sure of a good start, and after the small amount of coke charged has taken fire the remainder of the bed is put in and the iron and coke charged in until the cupola is filled, when the blast is put on at once and gradually increased until the iron commences to run. There is considerable difference of opinion as to which is the best plan. I prefer the latter method after considerable experiment with both plans, as I have found that with the large bed of coke which is necessary in this style of cupola there is greater economy in putting on the blast gradually, as it is not so severe on the fresh fuel, and I have found that I have been able to melt more uniformly both as to speed and the heat of the iron throughout the entire heat than when I used the other method; so that, for some time past, we have only put on enough blast at the beginning of the heat so that when the iron commenced to run it will be hot enough not to foul the spout of the cupola, and when the cupola is stopped up we increase the blast pressure to the desired limit and let it remain during the rest of the heat. I don't want to be classed among those who believe that everything must be sacrificed to a low fuel ratio in melting iron, for I don't believe that there is any economy in saving a few pounds of fuel at the expense of several dollars' worth of castings. At the same time I would advise every foundry man who thinks that there is room for improvement in his practice to study well the principles which govern the combustion of fuel in the cupola, and to consider well every contemplated improvement. Above all, avoid making radical changes, as nothing is gained by such a course. All that goes into the cupola, both fuel and iron, should be carefully weighed and each charge of iron or fuel carefully leveled up before the next is put in. When making changes in your system of charging it is well to take note of whatever occurs during the heat, for future reference; such data may prove very useful in determining the cause of variations from one day to another; or, in the way of determining future changes.

When the limit of successful melting is reached the melter who has been using too much fuel will find that the less fuel he uses the softer his castings become, and that, as a rule, he can use more good scrap or No. 3 pig iron to produce castings to conform to a certain standard of working qualities than before. This is where the real benefit of a low fuel ratio comes in, and if the time should come when the price of iron reaches the average of 7 or 8 years ago, the advantage of using a larger proportion of No. 3 iron in a mixture will be even more apparent than it is now.

I have no doubt that many members of the convention have noticed the difference in the character of the castings produced from a given mixture of iron when the ratio of fuel to iron is high, say 1 to 7 or 8, and when the ratio is low, say 1 to 10 or 11. I have been so situated for several years that at intervals I have had an opportunity to study this difference with different mixtures of iron. The result has always been the same; a mixture which yielded good soft castings at 1 to 10 or 11, invariably produced hard castings at the end of the second or third heat when the fuel was increased to 1 to 7 or 8, and when we changed back to the old fuel ratio the mixture of iron could be changed back to its original proportions. The difference must be chargeable to the burning out of some element neces-

sary to produce softness in the iron to a greater degree when an excess of fuel is used than before. The same difference is noticed when from improper charging a given mixture of iron is melted at a slower rate than it should be with the same volume and pressure of blast. The melted iron passing down more slowly through the bed of fuel is subjected to the action of the blast for a longer period, and the castings made from it will be harder than they should be if the iron was melted more rapidly. The result is the same in both cases—a loss of silicon greater than is necessary in good practice.

I think that you will find that the loss of silicon affects the casting in this way, each unit of silicon in the iron exerts an influence upon a certain amount of the carbon which the iron contains, keeping it in the graphitic state. When a unit of silicon is burned out of the iron the carbon, which under its influence has retained in the graphitic state, combines with the iron, increasing the hardness of the casting, increasing the shrinkage or contraction and creating new and unforeseen strains in all irregular forms of castings, making their very strength an element of weakness. Added to this is the uncertainty of producing a given result and the increased cost of labor and expensive tools when such castings have to be machined, which unnecessary expense and trouble can all be avoided if more care is exercised in the melting of the iron through a more intelligent method of dealing with the various details of cupola practice, founded upon a better understanding of cause and effect and a common sense application of the principles which govern good practice.

There is no single item of foundry practice which has so prominently engaged the attention of practical foundrymen for the past four or five years as the matter of controlling mixtures of iron through the aid of chemical analysis. This question has been discussed pro and con in all the leading iron trade journals until it would seem to have been worn threadbare; but in spite of the prediction of those who were wedded to rule-of-thumb methods the idea has steadily gained ground, and each year sees an increase in the number of foundries which have adopted this method of securing uniformity in the character of their iron, and among those who have taken the matter up systematically are included many who at first were most skeptical as to the benefits to be derived from the adoption of the new system.

When dealing with this subject, it must be admitted that there were some grounds for the opposition which the introduction of this theory excited. There has been a great change in the views of those who advocated this change in the beginning, as a comparison with what was written several years ago, which our present experience will readily show. Many of the ideas or theories which were laid down as cast iron rules have been relegated to the scrap heap because of the results obtained by a more mature experience.

There is no more conservative class in the world than the practical foundrymen; they look with distrust upon those—even of their own class, who are in favor of introducing changes. It is not to be wondered at, therefore, that when the young student of metallurgy, who, as a graduate from some good technical school, had been selected to assist in improving the work of the foundry, sailed in with a confidence born of three or four years' speaking acquaintance with his subject, and endeavored to show the practical founder who had done good work since before he was born, that he was all wrong, and that his salvation depended upon his studying certain tables, formulated by some fellow whose name he had never heard before; it is not to be wondered at that he refused to study, and almost invariably requested the theoretical gentleman, in a manner not entirely consistent with the rules of common politeness, to go to a place where the climate is popularly supposed to be so hot, that even cast iron would be in a state of perpetual fluidity.

To-day, the theoretical and practical sides of the question are getting closer together, and our practical men are being awakened to the necessity of throwing prejudice to the winds, and adopting any common sense method which will promise to relieve them of expensive uncertainty.

In calling to our aid the services of the chemist, it is not necessary to ignore past experience of a practical nature, for unless the knowledge gained by practical experience is called to our aid in selecting samples for the laboratory, the results obtained from

the analyses will be of little use. Where it is customary to have a supply of each kind of iron used in the mixture, in the stock yard, it is a good plan to take each pile of iron by itself, select by fracture a number of pigs which, in the founder's judgment, will most nearly represent the average grade of that particular pile, and use them as a sample, drilling into the center of the fresh broken end of each pig with say a half-inch drill to the depth of half an inch, being careful not to get any of the sand or dross from the outside of the pigs into the drillings, as it would make the sample worthless. The drillings, when mixed thoroughly together, are to be wrapped in strong paper, labeled, and sent to some reputable chemist. It is not necessary for each particular foundry to have a laboratory or a chemist; nor would I advise any one to attempt to do their own work in an amateur way, as I believe that there is as much depending upon the skill in manipulating an analysis in all its stages, as there is in knowledge of the proper methods; therefore, it is better to have the work done at a laboratory which is engaged in such work on a large scale, because the work is generally done by the most improved methods, and the reputation of the chemist in charge is at stake when the result of his work is questioned; hence the work of a reputable chemist, is, in the long run, the most satisfactory, even if it does cost a little more.

By treating each lot of iron in this way, and using the resulting analyses as a basis to make a mixture for the particular class of work required, a greater degree of uniformity will result, provided that in taking the iron from the pile for each heat, the melter will keep the average grade upon which the sample was made, constantly in view; that is, he should try to have what he takes from the pile each day represent a fair average of the grade of the pile. To the practical melter this is not so great a task as it would seem to those who are not familiar with the handling of pig iron; far from it; it is simply combining the best feature of the old practice of judging the iron by fracture, with the new practice of determining the extent to which an iron can or should be used, by a knowledge of the truth as regards what it contains.

This method of sampling has stood the test for several years, and will, I think, give a greater degree of uniformity in the product, for a small outlay, for chemical work, than any method which has come to my knowledge. One of the greatest obstacles in the way of the adoption of chemical analysis as a basis for making mixtures of iron for the foundry, in the past, has been, careless or unsystematic sampling. Unless the sample fairly represents the characteristics of the pile of iron from which it is taken, it is useless to try to depend upon the analysis made from it. In the same way samples of fuel should be made. If coke is used, a small piece may be taken from the sides of the large lumps at intervals of 18" to 24" over a pile or carload; these should be pounded in a cast iron mortar and the dust carefully made up into a package, labeled and sent to the chemist for analysis. When it is suspected that the coke contains an excess of sulphur, traces of which will frequently be seen in the black ends of such coke, it is safe to include in the sample to be analyzed, enough samples of the black ends to fairly represent the average of that kind in the pile or carload. Good coke for foundry purposes should not exceed one per cent in sulphur when soft castings are desired, and we should have as much less as we can get, and when melting large quantities of iron, a coke which contains less than 10 per cent of ash is apt to prove too soft to bear the weight of the iron.

In buying coke with which to melt iron, it is a safe prediction that the best is none too good, and will prove the cheapest in the end. A ton of coke will melt several tons of iron; if a coke which contains 0.75 per cent of sulphur will produce with a mixture of No. 2 irons, castings which are satisfactory in every respect, and a coke is substituted which contains double the amount of sulphur, it will be necessary to use nearly all No. 1 iron of the same brands, even when using only the sprues and scrap made each day, to make castings which will be as satisfactory as when the No. 2 mixture and purer coke were used. The difference in the cost of the iron alone, shows that we cannot afford to use poor fuel if we get it for nothing.

When accurate analyses of the iron and fuel have been obtained, the next step to be

taken is to decide what shall be the standard for the new mixture. I know of no better way for the beginner than to select one or more castings which have proved to be entirely satisfactory; take drillings from them and take the analysis of the drillings for the basis upon which to proceed. In calculating the silicon for a mixture, it is safe to allow at the outset at least 25-100 more than there was in the casting which represents your standard, to make up for furnace changes, and I have known several cases where it was necessary to allow more. The phosphorus in the mixture should be left the same as in the casting, and unless you are making special work with which it would interfere, it is safe to have it from 0.50 to 0.75 per cent, because of its tendency to increase fluidity and diminish shrinkage. Unless you use irons which are low in silicon, no special attention need be paid to the sulphur in your pig iron; as a rule, irons which are high in silicon are low in sulphur; in fact, the conditions which tend to increase the silicon contents of an iron in the blast furnace, have a tendency to diminish the sulphur. For similar reasons the manganese content of a mixture of ordinary foundry irons, plays an unimportant part; it does not often exceed 0.75 per cent, and is more frequently about 0.50 per cent, and at that proportion it does not interfere with the working qualities of good gray iron castings, whatever may be said of its influence upon iron in some of its other forms or conditions.

Having arranged the proportion of the different brands of iron which will best give the desired per cent of the four elements before named, you can estimate the value of the sprues and scrap resulting from the previous heat, if it is not convenient to have a sample taken from these analyzed, and by having an analysis made from a sample which will fairly represent the product, you will have a starting point, from which you can depend upon getting fairly correct results.

At this point I want to say to those who propose making this change in their system of making mixtures of iron, that they must not be discouraged if the first confirmatory analysis which they get, does not fully meet their expectations in every respect; repeated trials, aided by a common sense application of the experience gained in a practical way, will show you why you have failed in the first attempt. Remember, that every difficulty surmounted by patient investigation, leaves you better equipped to contend with the next difficulty which confronts you.

In controlling a mixture of iron made upon the basis of its chemical analysis it is not usually necessary to watch closely any of the elements which it contains except the silicon and the sulphur, particularly the latter. Silicon is the most variable constituent in iron, but fortunately its influence is such that a change of a small fraction of a per cent is not readily detected by any physical test, if the other elements remain constant. Phosphorus has been considered the greatest element of danger in iron on account of its baneful influence upon malleable iron, and steel in all its forms, due to its tendency to promote crystallization; cast iron being of a crystalline structure, and not being subject to any treatment which tends to change that structure from the conditions which were produced by the process of casting the metal, there is no reason to fear the result of using sufficient phosphorus to aid in imparting fluidity to the iron, except in some special cases, but for ordinary work, 0.75 per cent of phosphorus in the mixture will, when the silicon is in the vicinity of 2.25 per cent make a softer, sounder and stronger casting than if the silicon alone is relied upon for fluidity. Aside from its tendency to promote fluidity in the melted iron, phosphorus decreases shrinkage or contraction; the benefits to be derived from this characteristic in a mixture of iron, in the way of reducing the amount of initial strains in irregular forms or castings, is now being recognized by those who are engaged in such work, and in many other instances, irons containing a liberal per cent of phosphorus are being selected by founders who have no knowledge of their chemical contents, because the castings made from such a mixture are less liable to break when subjected to shocks.

Sulphur may well be considered the foundryman's "bane;" there is no doubt that it is responsible for more of the troubles which occur to impair the quality of the casting, than any other element contained in ordinary foundry iron. Sulphur promotes an increase of shrinkage and hardness by its ten-

dency to facilitate the increase in combined carbon. If asked to name two of the most common troubles to be met with in foundries making ordinary gray iron castings, I would answer, hard iron and blow holes; these two troubles are the most common and at the same time the most difficult to contend with. Unless the cause is well understood, sulphur is usually to blame for both, making the iron harder by increasing the per cent of combined carbon; and by its tendency to make the melted iron sluggish and full of gas, which can be seen to escape in small puffs as the iron cools in the ladle, it makes it practically impossible to make castings free from blow holes when 0.10 per cent of sulphur is present in the casting.

Sulphur is rarely found to exceed 0.060 per cent in ordinary foundry irons and is usually less than half that amount, so that it is to the fuel we must look, as the principal source of danger. Good foundry coke should not exceed 0.75 per cent in sulphur; with such a coke there would be no trouble in making soft castings; but such coke is not as easily obtained at present as we could wish, so we have to increase the limit to 1.00 per cent, and even at that, some unscrupulous dealers will endeavor to run in an occasional carload of coke which is so high in sulphur that it will harden the softest mixture of iron that we can get; in such cases, the benefits of chemistry are beyond computation, since by giving us the per cent of sulphur in the fuel and in the product, the cause of the trouble can be decided beyond question, and the proper remedy indicated.

In melting iron with coke, it is necessary to provide a flux which will impart fluidity to the ash of the coke and make it run off the top of the iron in the form of slag. Limestone is most commonly used for flux at the rate of about 40 pounds to the ton of iron charged into the cupola. The lime, beside imparting fluidity to the refuse matter in the cupola, has a tendency to absorb the sulphur from the iron as it drips down in melting through the slag which floats upon the melted iron in the bottom of the cupola; if this slag is even slightly basic in its character, it assists in removing the sulphur from the iron. And again, the deleterious effects of sulphur may be somewhat counteracted by increasing the per cent of phosphorus in the mixture; not as some are led to suppose, by removing any part of the sulphur in the iron, but by increasing the fluidity of the metal and prolonging its life in the ladle; it affords better opportunity for the gases to escape, and the slower rate of cooling seems in a measure to correct the tendency to abnormal contraction in the casting.

These suggestions are made with a view to aid the beginner in correcting troubles which are most commonly met in the average foundry. It must be borne in mind, however, that in the beginning, and until the founder has thoroughly gone over the ground covered by the range of his work, changes should be carefully made, and each contemplated improvement carefully considered.

Much harm has been done in the past by founders jumping at conclusions without sufficient experiment. It must also be borne in mind that while in a measure, certain chemical contents in a mixture of iron produce certain physical results in the casting, a material change in the proportions of the different elements in a mixture may produce widely different results from what is intended, unless the reasons are fully understood. The term material change, will have to be understood as differing widely in proportion, when it is used in connection with the different elements. What would be a material change in the sulphur, would not be sufficient to be noticed when phosphorus or manganese is considered; and what would be a material change in the proportion of the two last named elements would not, when applied to the silicon, seriously affect the result. The founder will also have to bear in mind that although a change in the proportions of certain elements will produce good results, a further change in the same direction will often lead to a return of the previous condition. It has been noted by those who have to deal with castings of irregular form, that there are certain combinations of silicon and phosphorus which will produce perfectly sound castings, when they would otherwise be porous or spongy, and that a further increase of one or both elements, would result in the spongy or porous spots appearing again in the same manner as before.

To the beginner, the matter of making mixtures of iron on the basis of chemical analyses, is likely to seem a more formidable

task than it really is. The fact that mixtures of iron have been successfully made by simply estimating the extent to which each kind of iron could be used, goes to prove that extreme nicety of calculation is not absolutely necessary to success. With the exception of sulphur and combined carbon, there is considerable latitude for change in the variable elements contained in the mixture, before any serious trouble will be experienced. After the founder has learned to figure out his mixture on the basis of the analyses of his stock, with a liberal allowance for furnace changes, if he is careful to keep his method of charging the cupola, the volume and pressure of the blast and the rate of melting, as nearly uniform as possible each day, there will be, if the stock has been properly sampled, but little chance for variation in the product which will affect the physical character of the casting. When he has reached that stage, he must constantly bear in mind that the character of the product from a given mixture depends upon keeping the relative proportions of the different elements practically the same while the mixture is used. He must also bear in mind, when making changes, that the influence of the different elements which affect the working qualities of the iron, is not always the same, but varies as the proportion of that element varies in the mixture. He must learn that an excess of silicon produces hardness above 3 per cent; that above 1.00 per cent of phosphorus produces weakness, that when the sulphur reaches .05 per cent, it is likely to make the casting hard, and, to increase the tendency to blow holes; that the manganese in a mixture for castings, which have to be annealed, should not exceed 0.75 per cent on account of its tendency to interfere with the conversion of the carbon at any heat below the melting point.

When the limits of what is safe for his particular class of work have been once established in his mind, he will be able to take care of any changes which occur by simply submitting a sample of whatever is abnormal in his product, to his chemist, who will put him in possession of the truth with regard to the trouble so quickly, that expensive mistakes may be avoided, and the necessity for tedious experimenting entirely removed, and the experience gained in tracing out errors in this way will make the correction of each succeeding variation a much easier task than before.

The number of analyses made in the beginning, will, of necessity, be much greater than after the value of the work has been more firmly fixed in the founder's mind, and my own experience leads me to believe that after the first year, the cost will be so small that it will not be worth considering.

As a matter of economy, making mixtures of iron from analyses is a good investment, because, in any foundry, doing even a moderate amount of business, one case of trouble with the iron, will cost more than the necessary analyses for a year's work, when to this is added the greater degree of uniformity, and the freedom from serious variation, and the ability to use stock which is closer to the limit of what is actually needed, which enables a foundry to buy cheaper than when a higher factor of safety is necessary. It seems to me that it is to the advantage of every foundryman who consults his own best interests, to investigate this matter thoroughly, and adopt it as far as the character of his work may warrant its adoption. It is not necessary, in adopting this method of making mixtures of iron, for the foundry to buy iron on a guaranteed analysis, as that would tend to increase the cost of the stock; while I firmly believe that in the near future all foundry irons will be sold by analysis, such is not now the case, and only a comparatively small number of furnaces furnish their customers with a reliable analysis of the iron which they sell. What is most necessary now, is a better knowledge of what the iron contains, and a sufficient familiarity with the proper methods of applying that knowledge, so that we can make a mixture suitable for our needs from the irons which we can buy the cheapest; when we reach that point we will be independent of any particular brand of iron, and should be able to effect a considerable saving as compared with former methods.

As has been well said in the past, there is no such thing as bad iron; all iron is good for some purpose if its quality is accurately determined. All that is needed by the founder who bases his mixture upon its analysis, is that the furnace or selling agent furnish a reliable analyses of the iron sent in any shipment, and the melter can do the rest. This relieves the maker of the iron of

all further responsibility in regard to the use of the iron, and from many of the vexatious troubles which are now of daily occurrence; it also relieves the melter of a great deal of anxiety, which under the old system was almost, if not entirely, unavoidable, and more than all this, when any trouble arises, it finds him in a position to determine accurately what the cause of the trouble really is, and when that is known, the remedy is easily applied.

In conclusion, let me say that the whole subject may be summed up in a few words. We have arrived at a point where the trend of progressive foundry practice is more than ever, in the direction of a search for truth in regard to making mixtures of iron for foundry purposes. The experiences of the past have proven the unreliability of the old system, when accurate results are desired. We have experimented long enough to know that in order to meet the increasing demand for greater uniformity in our product, we must have some better guide to aid us in mixing irons than a grading which is based upon fracture alone. Close competition is compelling us to relinquish one by one, the prejudices of the past, and to call to our aid the truths which science has revealed to us, ignorance of which has led us into all the troubles of the past. With these truths before us, no backward steps must be taken. The achievements of the nineteenth century have made it a safe prediction, that the march of improvement will still go on, and the foundryman who desires to keep up with the procession, will have to give more attention to the study of scientific methods of dealing with practical foundry problems.

Philadelphia Foundrymen's Association.

The regular monthly meeting of the Foundrymen's Association was held at the Manufacturers' Club in Philadelphia on Wednesday, June 2, the president, P. D. Wanner, presiding. After reports had been received as to the condition of business in different sections of the country there followed a paper by S. S. Knight on

THE FLETCHER PROCESS IN PIPE FOUNDING.

The cast iron foundry business, and particularly that part which has to do with pipe making, seems to have remained almost dormant for the past twenty years. By this statement is meant, not that all of the details of the pipe foundry business have been retained unchanged in all that period, but that no material or striking advancement has been made since the vertical casting of pipe was inaugurated. How far-reaching the benefits of this method were we should not forget, but, although it greatly lessened the chances of loss from such defects as one sidedness or lack of symmetry, it did not materially decrease the cost of production. It should be remembered that in pipe making one of the greatest costs aside from the metal is the mold and the labor necessary to clean the product and render it marketable. In the molding, the chief cost is the making of the core and the maintaining of the barrel or core bar in working shape, especially for smaller pipe, such as 3, 4 and 6 inches.

In the cost of the core we will first consider the materials used in its manufacture. By far the most costly of these is the hay rope, or loose hay that is put on as the combustible layer. This is then covered with clay, and this in turn with the so-called first coat, usually made of clay and dirt taken from previous cores. The bar or barrel with this covering is now dried. It is then taken out and upon it is turned the last finish coating of sand, sawdust and previously used core dirt, after which it is given a coat of blacking. The finished core is now dried. This core when used burns and vents well, but leaves the core dirt stuck fast to the interior of the pipe. Since so much clay is used in making the core, the dirt has to be in a large measure cut out and much labor is required to clean a pipe so made so that a coating of tar paint can be applied. The two objections to this process will be noted—viz., the cost of the hay rope which, on a 6-inch bar amounts to over 5 cents, and the labor required to clean pipe cast with such cores, due to the amount of clay used in their manufacture.

Among the recent improvements that have come forward in the pipe foundry business, none seems more deserving of consideration and use than that proposed by Dr. Fletcher, of Cincinnati, for making the cores just described. His invention was the result of patient labor extending over a time of seven years, and although he met with pronounced

minor success, he did not stop until he had given to the trade a method simple and economical and which masters both of the difficulties pointed out in the use of the old method.

Early in the 90's Dr. Fletcher began experimenting with a view of doing away with the hay rope used. To accomplish this mixtures of combustible substances such as sawdust, leaves, etc., and earthy or mineral cements were made. The proportions were varied in every reasonable way and with more or less success. But not until more recently did he conceive of his present method, which at this time stands perfected in every detail. The method consists of mixing starch hydrated in water with sawdust, or any comminuted combustible material, and applying this to the bar or barrel directly, by means of a wire gauze which passes under the bar and off from one roll on to another, the two rolls being geared to the bar. A 2 per cent solution of starch is used, and in practice is mixed with an equal bulk of sawdust. About 25 per cent of this starch solution is saved by being squeezed out by the gauze and collected, and is again ready for use. After the bar is covered with the sawdust mixture it is placed in the oven and dried, when it is ready for the first and only coat of dirt. This dirt is the same in composition as the last coating in the old process, and since it contains no clay, it can be easily washed out of the pipe.

The cost of applying this process on a 6-inch bar is less than 1 cent, or a saving of 4 cents on the combustible coating on a single bar. In this new process only one-half of the dirt usually used is required and the saving in labor in the cleaning shed amounts to fully one-half. But a virtue of no small importance is the increased size of the bars used on all small pipe, since the coating may be put on any thickness desired. This increased size of the bars allows them to withstand rougher usage and materially prolongs their life. Since no clay is used in the core dirt the core is very porous and vents well. The gases forming near the molten iron escape back through the core and thus the danger of blow holes in the iron is reduced to a minimum.

The paper was discussed by E. A. Kebler, of the Matthew Addy Company, Cincinnati, who said that the inventor of the process was a man of genius and might have discovered a process which would do what was claimed. In England, he said, they had done away with hay rope entirely and used collapsible bars, but with hay rope at present prices, compared with the expense of keeping up collapsible bars of different kinds, he thought hay rope still had the advantage in point of economy, unless Dr. Fletcher's process was found practicable.

Secretary Evans called the attention of the meeting to a new process in cupola practice being introduced as the Doherty process. The process was no more nor less than the introduction of a steam jet about opposite to each tuyere. A 1-inch pipe circled around the inside of the cupola, and a ¼-inch pipe running from the 1-inch pipe, with a nipple or tee on it, mixed steam with the blast. It was claimed that by the process the worst kind of scrap could be melted, and that the iron was softened by the process and made a very close casting. He said he had been in communication with Mr. Doherty, and had received a booklet on the subject of the process. He, the secretary, had been of the opinion that he had heard of a similar process before, and on inquiry found that Mr. Carlton, of the Pratt & Whitney Company, had used steam in this way years ago, but for want of time for experiments gave the matter up.

Mr. Ellicott said he had heard of steam being introduced in the blast furnace but not in the cupola.

Mr. Williams reported that he had used a steam jet in an experimental way, but the difficulty he had experienced was in getting steam dry enough. He had met with success at times, but the supply of dry steam could not be maintained.

Geo. C. Davis, chemist to Thos. Devlin & Co., Philadelphia, then addressed the meeting: "I have received several letters in regard to my paper, 'Notes on Malleable Cast Iron,' read before this association at the last meeting, and I take this opportunity to reply briefly. One correspondent writes: 'You say that silicon should be between 0.60 to 0.90 to obtain the best results. The majority of our customers ask for silicon from 1 to 1.25 rather than below 1 per cent.' Some use it as high as 2.50, but this, of course, is for melting with large amounts of sprue. This gentleman is speaking of pig iron, while my remarks applied to castings. Taking into consideration the oxidation of silicon in

melting, our views coincide. My remarks as to sulphur in charcoal iron were based on analyses of representative lots of different brands made by well-known analysts. One charcoal iron company recently sent me a report of an analysis of a No. 1 iron made by seven different chemists. Six of them varied from 0.010 to 0.027, while a firm of public analysts here who are usually considered 'a court of last resort' in matters of this kind reported 0.017. A sample of No. 4 of the same brand as mentioned showed 0.023 according to one public analyst whose method included examination in soluble residue, while three technical chemists reported 0.017, 0.017 and 0.018 respectively on the same sample. Much of the discrepancy is due to difference in method, but we find that the best chemists do not confirm the low results for this class of iron."

The meeting then adjourned until the first Wednesday in September.

CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and using Cast Iron. Address all Inquiries to W. J. KEEP, care of The Foundry.

Mechanical Analysis or Chemical Analysis for Regulating Foundry Iron Mixtures.

Chemical Analysis. By this term it is understood that each carload of coke and iron which is received shall have its chemical composition determined. The chemist shall know what composition is best for each kind of castings, and shall calculate how much of each pig iron shall be used to produce the desired chemical composition in the casting, and it is claimed that this will produce a corresponding physical character. In practice silicon and possibly sulphur are the only elements determined.

Physical Tests are generally understood to be the breaking transversely, or by tension, a test bar which has a cross section of one square inch. Chemists sometimes recommend that this test be used in connection with chemical analysis.

Mechanical Analysis is founded upon my discovery in 1885 that the shrinkage of a test bar varies inversely as the silicon in the casting. In other words, the measure of shrinkage is practically equivalent to a chemical analysis of silicon. It is also founded on the fact that the physical properties, aside from shrinkage and softness, are not wholly dependent upon the chemical composition of the casting. Mechanical analysis measures the physical properties of the iron, which are shrinkage, strength, deflection, set and depth of chill. Each foundry fixes upon its best record as its standard, and all future records are relative, that is, so much more or less than this standard. If the shrinkage is higher than the standard more silicon is needed, if lower less silicon is required; that is, the more scrap may be used.

Chemical and Mechanical Analysis each determine whether more or less silicon is needed, and both aim to produce castings having the best physical composition. Each approaches the subject from an opposite direction. The chemist calculates a chemical composition which he predicts will produce the desired physical composition. To find whether his calculation was correct it is necessary for him to determine the physical quality. The mechanical method measures the physical quality first, and the variation in shrinkage tells what chemical change is needed to more nearly reach the standard.

Cost of Each Method The use of chemical analysis requires the installation of a laboratory at an expense of from $200 to $400. To this must be added the employment of a chemist, the expense of chemicals and breakage of apparatus, fuel and assistance, which would cost about $2,500 each year. Mechanical analysis uses an apparatus costing about $200. Test bars cost but a few cents and the foreman can determine the physical quality in a few moments.

It can be used alone, as it gives all necessary information, but the most complete results would be obtained by a combination of both methods.

Foundation Principles These have been determined by a combination of mechanical and chemical analysis.

A test bar having a section of one square inch broken transversely will not indicate the strength of irons having different chemical composition, as well as bars either smaller or larger than one inch. The reason

for this is that a test bar having a one-inch section gives nearly the same strength for irons which differ widely in chemical composition, while a test bar one-half to three-quarters of an inch square, or larger than two inches square, gives a record which varies more nearly with changes in chemical composition. The fact that a one-inch test bar gives nearly uniform results for all irons has created the impression that this size was especially desirable for use as a test bar.

Very little has been added to our knowledge of cast iron by tests made with a test bar of one square inch section.

The size of test bar which will show the greatest variation in strength and shrinkage, for the smallest variation in chemical composition is the best size for mechanical analysis.

An increase of silicon will change combined carbon (white iron) into graphite (gray iron) and in this way removes brittleness and hardness, makes the grain more open and reduces shrinkage.

An increase of silicon, because of its removing brittleness, generally increases the strength of small castings, but it decreases the strength of large castings poured from the same iron.

An increase of silicon will generally overcome the influence of sulphur or any other adverse influence.

When both are poured from the same iron, a small casting which cools quickly will have a closer grain, and will thus have greater strength than a large casting which cools more slowly.

The slow cooling of large castings gives more time for silicon to act on carbon, and the grain is therefore more open and the casting is consequently weaker in proportion to its size.

For these reasons the strength and shrinkage of castings cannot be correctly calculated by any mathematical formula which uses the strength and shrinkage obtained from a test bar of a different size.

I have constructed a chart by which, with any size of test bar, the strength or shrinkage of any other size of test bar or casting can be closely approximated graphically.

To locate two points on the curves in this chart I would recommend the use of two sizes of test bars cast from one gate, one of which shall be half an inch square and the other one inch square.

Whether chemical or mechanical analysis is used, any estimate regarding the physical quality of a casting is only approximate, because conditions attending melting which are not under the control of the melter and cannot be provided for, often exert a greater influence on the casting than variations in the chemical composition.

Drawbacks to Chemical Analysis A chemist must be employed and a laboratory provided. To be successful even in a small foundry the chemist must give his whole time, if each iron and the coke are to be subjected to anything like a complete analysis.

Analysis has been found to be slow, especially if other elements than silicon are determined.

For this reason it is necessary to purchase iron far in advance of needs, and there must be room to pile each carload by itself. This adds to the expense of transportation from the yard to the cupola.

With limited yard capacity pig iron must be piled quite high, and when used that on top must be used without reference to its car number, in which case analysis would be of little use.

If, as is usual with small founders, iron is purchased as needed, there would not be time for analysis.

There is always a difficulty in sampling. Chemists are not agreed as to the most desirable part of a pig from which to take drillings, and a few grains of sand from the surface would render analysis worthless. The chemist would be obliged to watch each step, for the class of men employed in a foundry yard cannot be intrusted with this work.

Pig iron is not homogeneous, therefore drillings taken from one part may not represent the average of the whole pig, much less of the whole carload, even if the drillings are taken from twenty-five pigs.

The small fraction of an ounce of drillings used for the determination of the chemical composition of a carload of iron makes the chance of error very great.

In most foundries a large proportion of scrap is used, and as each piece of scrap comes from a different foundry mixture, no correct analysis can be made.

Scrap iron has been melted in a cupola, and the appearance of its fracture is a more

reliable guide as to its quality than the appearance of the fracture of pig iron.

The appearance of the fracture of pig iron does not always indicate the character of the iron. One iron with a very close grain but containing considerable silicon may make very soft castings, while another dark open pig iron deficient in silicon may make castings which are nearly white.

This fact makes chemical analysis of pig iron very desirable, though fortunately the appearance of the fracture generally indicates the quality.

On the other hand, two irons showing exactly the same chemical composition will sometimes produce castings having totally different physical qualities.

The chemist does not like to admit this fact, because the success of chemical analysis depends upon the supposition that the same physical quality always accompanies a given chemical composition, and it cannot take account of the unforeseen conditions which often entirely alter the physical character of the castings.

Strength is almost entirely dependent upon the size and shape of the grain, and is not to any great extent dependent upon the chemical composition.

Some chemists who are aware of these facts advocate physical tests as an accompaniment to chemical analysis.

These difficulties in the way of chemical analysis exist, but the fact remains that this is the only means of determining the chemical composition of the iron in percentages.

Advantages of Mechanical Analysis. It is cheap and quick, and can be operated by anyone of ordinary intelligence. It tells the founder exactly what physical properties his castings have, and tells him exactly what to do to bring each physical quality to a standard. It tells whether more or less silicon is needed to overcome all influences whether due to chemical change or adverse conditions which cannot be foreseen.

The founder will order chemical determinations when needed to check his work.

If it is desired to purchase a lower priced iron, order a carload and substitute a small quantity of it in the mixture in place of an equal quantity of the iron which it is to replace.

If the shrinkage decreases it is a better scrap carrier than the other. If the shrinkage increases, silicon must be made up in some other way, and the new iron may not be economical at a reduced price. The same process tells which irons in a mixture are most economical, and which contain most silicon.

The objection made by chemists to mechanical analysis is that it gives information after the castings are made.

Mechanical analysis assumes that the founder uses more than one iron in his mixture (the more the better), which would prevent variation in different parts of a pile of iron from exerting a decided influence on the castings, and that he makes no radical change at any time. When a change is made it is to get closer to the standard or to reduce cost.

If only untried irons were to be charged, chemical analysis would be of considerable advantage, though as a general thing the appearance of the fracture would be as safe a guide.

When this first cast was made a mechanical analysis would be made, which would show the exact quality of the casting and what change was needed, without its being necessary for the founder to examine into the reason for the lack of uniformity between the chemical prescription for the mixture and the physical result. For the second day, and ever after, mechanical analysis is, at least, just as good as chemical analysis.

There are classes of special work requiring specific percentages of one or more elements, where chemical analysis must be employed.

Antagonism to Mechanical Analysis. There is no reason why the chemist should oppose it, because both mechanical and chemical analysis employ the chemical elements in exactly the same way to alter the physical quality of the casting, and all agree that the more chemical determinations the better.

Antagonism seems to be caused by the fact that a founder, when necessary, can get along very successfully with mechanical analysis.

Antagonism seems to come from chemists who are not acquainted with the requirements of foundry work, and who do not understand mechanical analysis.

It also seems to come from chemists who have laboratories, and who wish founders to send drillings to them and allow them to direct the iron mixture from a distance.

It seems to come from chemists in the employ of founders, who do not desire to assume the practical position of foreman, and who are aware that mechanical analysis could be employed without their help.

It also comes from founders who neither understand chemical or mechanical analysis, and who imagine that because chemical analysis requires the employment of a man of education, it must be the scientific method.

There should be no antagonism. The result is exactly the same by either method. It is only a question of which is the best way to get at it if only one can be employed.

Which is the Most Scientific Method? Those antagonistic to mechanical analysis occasionally call it "rule of thumb."

The most scientific method is that which is founded upon the most correct principles, and which gives the most correct information in the quickest way, and which can be used by the men who need it.

It is not necessary that a scientific method should be one which can only be used by the graduate from a chemical school, and it is not certain that methods which can be used by every founder are for that reason "rule of thumb."

The results obtained by the use of a method must determine its value.

Chemical analysis alone, or even when accompanied by the ordinary transverse breaking of test bars having a one-inch section, has done very little towards determining in cast iron the influence of the ordinary chemical elements upon the physical quality of cast iron.

Professor Thomas Turner, of Birmingham, England, in 1885 made ten series of test bars in which silicon was the only variable, and by physical tests proved the influence of silicon. The chemical analysis of all elements added greatly to the value of the tests, but was not the means used to determine the influence of silicon.

Nearly all of our present knowledge regarding the influence of carbon, phosphorus, sulphur and manganese has been gained by making a large number of series of test bars in which a single element varied, and then determining its influence by mechanical analysis. The amount of each element in the irons melted and in the test bars was found by chemical analysis, but this did not give any idea of the influence exerted.

The change was physical and could only be found by physical methods.

Before mechanical analysis could be used in the foundry to control the iron mixture, it was necessary to determine the influence of each chemical element.

Founders who are thorough chemists soon find that the most practical way to control their mixture is by mechanical analysis.

For a number of years there has seemed to be one exception to this. One founder who is a practical chemist opposed mechanical analysis, and claimed to arrange each day's mixture in his foundry by pure chemical analysis, and he said that he found an exact correspondence between his chemical prescriptions and the physical results. When asked to explain his method he claimed that it was his own secret.

In January of this year (1897) he presented before the Foundrymen's Association of Philadelphia a paper describing his castings and explained his method, which was the determining of shrinkage, chill and strength by physical tests, and he uses the following language regarding his mixture: "Its physical characters were *attained by properly calculating the ultimate chemical composition for cupola charges and* maintained without regular analysis of the casting, *by translating* the small daily variations in physical test pieces and castings *into chemical equivalents*, indicating the *chemical* change to be made on the charge. Thus in spite of the usual cupola return of scrap, and other adverse conditions, the charges are regulated to produce practically equivalent castings."

I have placed all words which treat of imaginary processes in italics. Now read again the part in ordinary type and you have as good a description of the mechanical analysis as I could formulate.

The user of mechanical analysis is using chemistry all the time, but says and thinks very little about it. He has only time for results.

Before I undertake any investigation I get the best chemists in the country to join with me. Messrs. Dickman and Mackenzie, of Chicago, have made the determinations for most of this work since 1894. I have never

had any cause to oppose chemical analysis where it is practical to employ it in the foundry.

When the chemist becomes the practical founder there is no antagonism between chemical and mechanical analysis.

Chill.

By S. S. KNIGHT.

At such a time as this when all prejudices are thrown aside and statements stand only upon their merit and the truth which they contain, when every sceptic has within his power the use of such apparatus as will put to the most crucial test the facts he may doubt, it behooves theorists to make the plainest statements of their conceptions, in order that they may convey to others their meaning unclouded and forcibly.

During the last year more has probably been written and more investigation made in all departments of scientific work than has ever been accomplished before in the same period of time. Among the industries which have been benefited by this activity we should not forget that with which, in the present case, we have to deal.

Investigation and advancement are now signs of the times, and the reason which has so often been given for any special mode of procedure, namely, that it always has been done so, is rapidly becoming obsolete.

Among the many things which have been agitated in the past few months with so much zest, is the subject as to whether soft iron melts at a higher temperature than hard iron. The author in referring to this subject before has given only the results of his observations, which, briefly stated, were these, namely, that Embreville No. 2 soft iron, containing in the neighborhood of 3.5 per cent. of silicon .25 per cent. of phosphorus, 3.3 per cent. of graphite carbon, with not to exceed .13 per cent. of combined carbon, and whose sulphur content was in the neighborhood of .025 per cent., fused at a temperature of 1.050 degrees Centigrade. He also found that the same brand of white iron containing .25 per cent. of silicon, and not to exceed .05 per cent. of sulphur, and whose carbon amounted to nearly 2.5 per cent., practically all of which was combined, and whose phosphorus was identical with the first fused at a temperature approximately 100 degrees higher. Both of these irons carried in the neighborhood of .75 per cent. of manganese.

These results were obtained by the use of the platinum-iridium couple, connected to a tangent galvanometer furnished with an astatic needle. The readings were almost identical when this system was directly connected to the galvanometer and also when a standard battery giving one ampere current with a difference of potential of 1.08 indicated volts. It may here be briefly stated for the benefit of those who do not possess a technical knowledge of electricity that the principle upon which the action of the first system depends is that when two electrically different bodies are heated to a high temperature with one of their extremities in mutual contact, that the amount of current produced is proportionate to the temperature attained, and that if their extremities not in contact be connected to an instrument which will indicate a delicate fluctuation of the electric current, and also of its quantity, that the temperature may be readily calculated. In the latter case a platinum wire is substituted for the couple, and the principle here involved is that the greater the amplitude of the vibrations of the particles of the conductor, which in this case is platinum, the greater the opposition to the flow of the current, and consequently since the amount of the current supplied is constant the less current the galvanometer will snow as the temperature of the wires rises. The reason that platinum and iridium are used is solely because at these high temperatures they are infusible, platinum fusing at 1775 degrees Centigrade and iridium at 1950 degrees.

It would only be fair to state in connection with the results here given that previous determinations upon the fusing points of hard and soft iron have resulted about as follows: White iron, 1135 degrees Centigrade, and gray iron, 1220 degrees. The figures here given come to the author second hand on the authority of Mr. Clark, who also gave them second hand in February, 1892. At the same time he stated that he did not know whom the observations were made by or what apparatus was used. Therefore it seems that very little authenticity can be attached to them.

In order to thoroughly understand why hard iron should fuse at a higher or lower

temperature than gray iron, it is necessary to have a knowledge of some of the properties of both varieties of metal, and some of the phenomena connected with each. In selecting metal for chilling mixtures, white or hard iron is invariably chosen; that is, the mixture must consist of an excess of this kind of iron. What is meant by this is that the amount of chill is proportionate to the hardness of the material used. In order to thoroughly understand what causes iron to chill we must necessarily refer to the science of molecular dynamics.

The square of the amplitude of the vibration of the component molecules of iron is proportionate to their absolute temperature. The energy which the molecules possess tending, if the body be confined in a containing vessel, to produce pressure, is directly proportionate to the absolute temperature of the body itself. This absolute temperature reckoned in degrees Centigrade is the normal temperature of the body plus 273 degrees, or the difference between zero of the Centigrade system and the absolute zero or the temperature at which the molecules possess no motion.

Since the energy of any molecule may be found by the formula $M V^2 \div 2$, where M equals the absolute mass and V the motion which the M. mass has reckoned in the units of the absolute or C. G. S. system, it easily follows that disregarding the mass, which in all cases remains constant, the square of the amplitude of vibration reckoned in units of time, or briefly of their velocity, would be directly proportionate to their absolute temperature. In order that the iron may chill, the amplitude of vibration of the molecules adjacent to the mold must be so diminished that before and while solidifying they will permit their neighboring molecules to remain, although in more or less vibration in a great deal closer position than it would be possible for them to occupy if their temperature were diminished gradually. It may readily be seen from this that in order to have the greatest chilling effect the mixture must be such that the average amount of heat contained in the molten metal and in the mold itself will be at a minimum. This may be demonstrated as follows: Let A equal the number of calories of heat which the molten metal itself contains and B equal the number of calories of heat which the mold contains. Now, if $A+B \div 2$ represent the temperature of the solidifying mass, then the less either the A or B factor becomes the greater becomes the chilling effect. Applying this directly to the case at hand, the factor is less in the case of hard iron than in that of soft. Consequently, other things being equal, the maximum chilling effect is produced when hard iron is used, since, as already stated by Mr. Clark, its fusion point is below that of gray iron. Of course in practice all acquainted with molding will understand that there are limits within which only it is safe to reduce the B factor in our computation, or the temperature of the mold, since if the mold be too cold, it is likely to crack on coming in contact with the molten metal.

This is the only theory that the author has been able to obtain, the knowledge of that supports the figures given by Mr. Clark. But even this does not take into account many things which undoubtedly, even if the theory be granted correct, would produce a greater or less effect upon the chilling metal. The conductivity of the chilling substance must be taken into consideration since all of the heat represented in the factor A is not available for use in keeping the iron in a molten condition, unless the conductivity of the metal itself were perfect. This necessarily follows since only a comparatively small portion of the fluid iron is in actual contact with the surface of the mold. We also must remember that a certain quantity of heat is generated by the solidification of the molten metal, and thus the chilling effect of the mold must be somewhat diminished by the result of its own action. We must at the same time remember that all those substances which expand upon solidifying, such as cast iron, water, etc., have their solidifying point greatly lowered by the application of pressure. Thus water under a pressure of several atmospheres may have its temperature reduced to 14 degrees Centigrade, and still remain liquid. Roughly speaking, for every five feet of height which the mold has when filled with molten iron, we have a pressure developed of one additional atmosphere. When these points are considered along with the theory just stated, the evidence is more in favor of the fusing points first given than those which are so popularly taken as correct.

While speaking of the action of chilling irons specially we may consider briefly in the same connection the effect of chilling in general. No chemical difference has ever been detected between the exterior chilled part and the interior unchilled iron of any casting. The phenomenon is due solely to physical rather than to chemical causes. In our previous consideration of the influence of quantities of heat upon chilling, we briefly recognized the potency of the conductivity of the metal in effecting the results. The thermal conductivity of pig metal is roughly proportionate to the graphite carbon which it contains. Hence if the pig metal contained approximately no graphite carbon, the factor of conductivity will tend to augment the chill and consequently, even although white iron melts at a temperature 100 degrees greater than gray iron, yet by its use a far deeper chill may be obtained. The reason for this is obvious in view of the facts that have been stated, because as rapidly as the white iron solidifies, it assumes the temperature of the surface of the mold, and hence acts as a chilling influence upon the adjacent molten iron, which subsequently hardens.

The effect of chilling influences upon castings in general has yet been very little investigated. Cases have frequently come under our observation where castings would exhibit abnormal transverse strength with comparatively small deflection. In many instances this effect was superinduced by the use of new sand, which gives to metal a decidedly closer grain than that which old and tempered sand will to the same iron. This effect may not always be accompanied by a discernable exterior chill, but it will readily be detected when the bars are subjected to machine tests. The results given below were from bars cast in new sand molds, and also from bars poured of the same iron and at the same time into old sand molds. The deflection will be noted especially in the former case and also the breaking strain of the individual bars as compared with their measurements.

BARS CAST IN NEW SAND.

Bar No.	B-k S.	D	Measurements.
1.....	2,020 lbs.	.25 in.	.985 in.x1.995 in.
2.....	2,115 lbs.	.26 in.	.975 in.x2.000 in.
3.....	2,325 lbs.	.29 in.	1.012 in.x2.010 in.
4.....	2,476 lbs.	.31 in.	.985 in.x2.010 in.
5.....	2,520 lbs.	.33 in.	1.000 in.x2,050 in.
6.....	2,670 lbs.	.34 in.	.995 in.x2.005 in.

BARS CAST IN OLD SAND.

7.....	1,880 lbs.	.35 in.	.975 in.x2.008 in.
8.....	1,905 lbs.	.38 in.	.980 in.x2.015 in.
9.....	1,950 lbs.	.40 in.	1.005 in.x .998 in.
10.....	2,025 lbs.	.44 in.	.985 in.x2.050 in.

While noting the effects of chilling influence caused by the character of the molds we should not alone consider the evidence which machine tests may produce upon transverse bars. It will be noticed that the size of the bar used is such that, roughly speaking, the breaking strain of this one by two inch bar is one-tenth of the tensile strain which a square inch section of the same metal will withstand without disruption. Two bars are therefore given below which will represent the actual tensile strength of a bar of one inch section which has been freed from exterior scale, thus making the metal subjected to strain uniform throughout.

Bars in New Sand.	Bars in Old Sand.
No. 1—1 sq. " sec. 26000	1 sq. " sec. 19000
No. 2—1 sq. " sec. 25600	1 sq. " sec. 19500

The discrepancy in the case of bars in new sand will be noticed, and although relatively slight, is yet significant.

While considering the subject of chill, it may be well to devote some consideration to the exactness or approximate accuracy by which silicon may be determined by its measurement. Within the last few years a number of machines have appeared upon the market for the purpose of estimating the amount of silicon by mechanical means. The estimation depends upon two things: First, the chill, and second, the shrinkage of iron. As to how much reliance can be placed upon chill in judging of a silicon content, we have noticed in a previous article. The same figures will also stand in the investigation as to how shrinkage is affected by quantities of silicon. It will readily be seen therefore that neither chill nor shrinkage will even approximately determine the amount of silicon an iron contains. And since by the use of test bars little can be told of the nature of the metal in the casting, we may safely conclude that only such mixtures as are made by analysis will in the long run be economical to iron manufacturers.

Richard E. Warner has been elected president of the New England Stove Manufacturers' Association.

The Plumbago Club.

The Plumbago Club has held some pretty interesting sessions in its days—or more properly speaking—its nights—but the gathering to which it invited its friends at the recent convention of the American Foundrymen's Association in Detroit was its crowning glory.

Sessions have been held regularly since the club's formation, but the publication of a portion of the proceedings had created so much excitement that Doorkeeper John Hill had received positive instructions not to admit any more newspaper men.

These instructions had been strictly carried out, and it became from the first apparent that the club had acted wisely in the selection of its doorkeeper.

His strong sphinx-like, vacant, non-committal face was of the greatest value as a support to the voluble manner in which he invariably explained the reasons why none but active members of the club could be admitted.

By the way, Mr. Hill's success in this line together with much personal magnetism and a manner that would convince any man or jury that he was innocent and possessed an unusually high degree of business integrity, is largely responsible for his large following among those who do—not—know him best, and makes the study of his character a trifle more difficult than a high grade Chinese puzzle.

At the session referred to, however, everybody was admitted, and the club kept open house, nearly one hundred altogether being present when Vice-President Smith called the session to order.

After remarking that one of the club's principal objects was the promotion of temperance, morality and low prices, he asked all present to drink the health of President J. S. Hibbs, who was prevented from being present by domestic cares and loss of appetite. The house with which Mr. Hibbs was connected had recently become incorporated and elected officers, consequently that gentleman had to spend the most of his time sitting on the stock market to prevent the stock from being quoted out of sight. Such spare moments as he had were devoted to the pleasant and easy task of making contracts to supply all the foundries south of New York and west of Philadelphia with everything they needed for the coming year, even to good times, if desired. This of course did not include iron, coke or orders, everything else went.

Mr. Smith said that as Mr. Hibbs was absent he had desired to seize the office of president himself, that in fact he had already seized it, and if President Hibbs wanted his job back he would have to come west in a hurry. He said further that he learned the president was spreading himself over the whole country, grabbing every order in sight, from a swab up, while the rest of the members were in Detroit, at great expense, without a thought of business, and only inspired with the idea of entertaining and making

BADGE OF THE PLUMBAGO CLUB.

life pleasant for the foundrymen attending the convention. He said further that he knew of several large contracts that would likely be secured by that gentleman in the absence from home of the balance of the members, and amid much excitement in all parts of the hall he was about to introduce a resolution denouncing the president's actions in this respect, when a messenger rushed in with a telegram, which was handed to the speaker. After reading it over once or twice Mr. Smith ordered the attendants to temporarily cease pulling corks while he read the following dated Washington, D. C.:

"J. D. Smith, Vice-President Plumbago Club, Detroit, Mich.:

"United States senate about to put a clause in the tariff putting duty of 100 per cent on plumbago. I have just got here and will address the senate to-morrow in a four-hour speech, afterwards will see President McKinley and talk to the senators personally. Am certain they will throw up both hands when they find out who I am. Have club immediately adopt resolutions and give to Associated Press. Be sure and say, I am on the spot.

"JOSEPH S. HIBBS,
"President Plumbago Club."

For a moment after the reading of the telegram a graveyard silence prevailed, as the awful possibility of the senate being successful in imposing this duty hung like a cloud of steam in a low foundry in winter over those present, but gradually a feeling of confidence seemed to come to all, as they realized that thir own active, resourceful, persuasive president, with his oleagenous manner, was among those senators.

The first one to wholly regain his composure (if he had ever lost it) was Mr. John A. Walker, of the Joseph Dixon Crucible Company, who addressed the chair briefly. There was, he said, no underestimating the seriousness of the situation. If the senate amendment carried we would be compelled naturally to get our castings made where the raw material was the cheapest, and he did not think that the iron foundries of Ceylon, where the plumbago came from, could furnish all that Americans needed, but as the Joseph Dixon Crucible Company controlled all the plumbago in that country and owned their own railroads and steamboats, they would do (as they always did) everything in their power to supply satisfactorily the wants of their friends—they never used the word "customers" because in their case their customers were their friends. He said further that this law would be a great advantage to his company, because they likewise owned what few graphite mines there were in America, but for all that, he thought it unjust, and moved that a committee of five be appointed to draft a resolution that would open the eyes of their mis-representatives at Washington.

Mr. Frohman seconded the motion and said he had prepared a paper containing a lot of statistics, showing the value of the plumbago imported into this country, and proving that the S. Obermayer Company were the greatest users, largest, etc., etc.—but he got no further—the members of the club would not have it, and the president ruled him out of order. The motion, however, was put and carried, and the president appointed J. A. Walker, H. F. Frohman, J. S. McCormick, G. S. Bullock and L. S. Brown, who immediately retired to an anteroom to prepare appropriate resolutions, the president giving strict orders that no refreshments be served them during their absence.

The chair then read the following telegrams:

"Pickwick, Pa., May 11, 1897.
"Plumbago Club, Detroit, Mich.:
"Sell lots of coke. We want work.
"COKE PICKERS' CLUB."

"New York, May 11, 1897.
"Plumbago Club, Detroit, Mich.:
"Regret exceedingly our inability to be with you this evening. We wish to be remembered to all.
"PIG IRON CLUB."

"Rotterdam, May 11, 1897.
"Plumbago Club, Detroit, Mich.:
"Quote lowest price five hundred barrels adulterated plumbago, New York.
"SCHWEINICKEL CO."

After directing the secretary to make suitable replies, Mr. H. S. Vrooman, of Chicago, read a paper prepared expressly for the club and entitled "Glue in Plumbago." The paper was as follows:

GLUE IN PLUMBAGO.

When intercelluar connective tissue, as met with in skin, tendons, ligaments and the fascia of the muscles, of which it forms a basis, is treated with water, preferably hot, or in the presence of dilute acids for some time, a solution is obtained which in cooling solidifies to a jelly. The same substance is obtained when the matrix of bones is submitted to similar treatment, after previous removal of the lime salts by means of mineral acids; again, when unossified cartilage is treated with water or dilute acids, a solution is obtained which also gelatinizes on cooling. The coagulation in this case, however, is due to a closely allied substance called chondrin.

At one time it was supposed that in each of these cases the gelatinizing materials obtained were formed by the hydration or by physical metamorphosis of a different substance pre-existing in the respective tissues, to which the names "collagen," "ossein" and "chondrogen" were given respectively. The two former yielding gelatine.

Glue is a form of gelatine which, on account of its impure condition, is employed only as an adhesive medium for wood, leather, paper and plumbago. There is, however, no absolute distinction between glue and gelatine, as they merge into each other by imperceptible degrees; and although the dark colored varieties of gelatine, which are known as ordinary glue are in no cases treated as food, yet for several purposes the fine, transparent kinds, prepared for culinary use are employed also as adhesive agents. Neither again, except in respect of its source, is there any chemical or physical distinction between these two substances, and therefore the industrial applications of these two varieties of commercial gelatine, viz., gelatine and glue, will be here noticed.

J. D. SMITH,

ONE OF THE PRESIDENTS OF THE PLUMBAGO CLUB, AND INCIDENTALLY A WELL KNOWN FOUNDRY SUPPLY MANUFACTURER AND DEALER.

As the use of glue in plumbago is the subject assigned me, we will treat of its use in this case only. Now plumbago is a substance more commonly called grapaite. It is used in molding and is sold from 2 to 6 cents a pound—it depends upon whom it is sold to as to what price it brings. It analyzes the same as the diamond, and from the number of diamonds I have seen in Detroit, I have come to the conclusion that Detroit must be a good market for plumbago.

It is most extensively used in a foundry for blacking molds. Now, as you know, plumbago is of a very greasy nature and has great lubricating qualities—that is, the best grades. These grades are very seldom seen in a foundry. I know that all foundry facing houses claim to be importers, but let me tell you on the quiet, they are not. Now the plumbago they use is little chips they buy from crucible manufacturing companies. These small particles they buy have no adhesive qualities. They buy them for almost nothing and because the crucible makers cannot use them.

Now, as it is necessary to have plumbago stick to a mold when applied, and as this has no adhesive qualities, the foundry supply house mix glue with it to make it stick. The American Glue Co., of Chicago, tell me they sold 7,000 barrels of glue for this purpose last year, and expected to double their sales for this purpose this year.

Now you can see that you are getting the worst of it. Here the use of a chemical laboratory would save you 96 per cent. I fully agree with Mr. S. S. Knight that chemistry is a good thing in a foundry.

Mr. Wm. Ferguson said he was glad he had been permitted to attend this session of the club. He had noticed for a long time that the plumbago they had been using had the effect of making the sand stick to the castings and the more plumbago they used the more the sand stuck. The mystery was now cleared up, hereafter he intended to import and mix his own plumbago. (Cheers.)

J. K. Pollock, of Rogers, Brown & Company, said his company was now placing on the market a special brand of iron that was made by them exclusively and which possessed certain qualities and elements that prevented the sand from sticking to the casting. It would run sharp and make a soft, strong, solid casting guaranteed not to crack, chill or wear, and would entirely revolutionize the foundry business in the near future. They intended to see that only the members of the Plumbago Club and its particular

friends were supplied as the demand was limited.

Mr. Pollock further said this latest blessing to the founder had been rendered possible by a close study of the proceedings of the various Foundrymen's Association and Keep's Cast-Iron notes, that the result had been secured by melting the ore in a center blast furnace, and using a large percentage of silicon plumbago and aluminum and permitting a certain amount of sour beer to find its way into the cupola through the fan or blower. This was known as the Damroty process.

Confidentially, he said, that the sour beer did the whole business and his company kept an office on Vine street, Cincinnati, for the purpose of securing all they could get of the latter article.

S. D. Sleeth, of the Westinghouse Air Brake Company thought a heavy coat of parting sand spread over the plumbago, with a strong solution of molasses had been found very effective in causing a parting between the plumbago and casting.

The discussion was prevented from going further by the return of the committee on resolutions, who presented the following report after taking some liquid nourishment:

Whereas, There exists a probability that the senate of the United States may impose a duty upon an article grown in the island of Ceylon and named after this club, and

Whereas, This product, owing to its peculiar character, is now being extensively used for a large number of purposes in this country, such as a wash for crucibles, for the purpose of greasing the surface of molds to permit the iron to run easily, as a paint intended to render it easy work to members of the club to enjoy themselves when out late at night, and

Whereas, The Joseph Dixon Crucible Company have recently received an order from Father Time for a year's supply to be used as a lubricant for the earth's axis, and

Whereas, The chief uses to which this material is put is to render more easy of accomplishment these things that are difficult, and

Whereas, It is well-known that one of the greatest requisites to secure successful legislation in these days is a liberal use of what is know as "Grease," etc., and

Whereas, Any legislation having for its object the placing of a tariff on this commodity would have the direct effect of making more difficult the enactment of necessary laws for the benefit of the few as against the many, and render almost profitless the business of being a lawmaker and would especially interfere with the just emolument of our United Sugar senators.

Therefore, Be it resolved by the Plumbago Club, in convention assembled, that in the interest of all whose lives are devoted to spending the money that other people earn, that we enter an emphatic protest against this proposed amendment, and

Be it further resolved, that if our senators insist upon placing a tariff on this product, that they be respectfully requested to observe the usual practice, and give the members of the club advance information and refer them to some reliable Wall street brokers, in order that we may have the same opportunities as the senate, and be it further

Resolved, That copies of these resolutions be sent by a trusty messenger to President J. S. Hibbs, who is now guarding our interests in the various places of popular resort at Washington, with the request that he furnish each senator secretly with a copy.

A standing vote was called for on the resolutions and everyone present jumped on his chair, held up both hands (feet, simultaneously) and gave the club yell, "Plum-Plum-Plumbago."

After order had been restored, President Smith said that he was determined to be president of the club, no vice business for him, and wanted someone to move that he be elected unanimously. No one, however, seemed willing to face the wrath of President Hibbs, although it was apparent that their vice-president had completely won their hearts by his captivating manner and his success in getting up the meeting.

The embarrassment was quickly removed by Howard Evans. He said one president was the ordinary number, even the United States managed to drag along with one, but this was not an ordinary society, and did not do things as they were done elsewhere, and he moved that the Plumbago Club have two presidents hereafter, and that J. D. Smith be one of them and that the installation ceremonies be immediately commenced.

The words were hardly out before an uproar commenced that shook the building, woke up the people three blocks away (and it was now after 2 a. m.) and brought the police.

After order had been restored, the broken glass cleared up and F. A. Goodrich had recovered from the fainting fit into which he had been thrown by the installation ceremonies and H. F. Frohman had loaned the president his own coat in which to make a respectable appearance (the president's garment having got the worst of it during the ceremony) the entertainment features of the programme were commenced—it had been strictly business before.

The first number on the programme was a combined recitation and song from J. M. Warner, at least it seemed to be combined, but opinions differed as to which class it should be placed in, but all agreed concerning the artistic manner in which it was rendered, and for an encore, Mr. Warner sang "Just Tell Them That You Saw Me" with variations. This was also favorably received, in spite of the omission of several lines.

L. S. Brown, of Springfield, Mass., kept the members of the club at a safe distance for a few minutes by talking to them. He was accused, however, of telling the truth, and compelled to sit down.

Martin Fox, of the Iron Molders' Union, did not know what to make of it, and said so, the club liked Mr. Fox and told him so. All hands wanted to talk at once, and Mr. Fox found his seat.

C. T. Holbrook was dragged to the platform and tried to tell the club why he was alive. He failed, though it seemed to puzzle him as well as those present, and they let him off easy. He was carried to his seat gently.

S. T. Johnston, of tht Whiting Foundry Equipment Company, gave as his excuse for being present the fact that he heard "everything in the house was on ice." He was permitted to live.

A. Sulzer, of Sulzer Brothers, Switzerland, was requested to give an excuse for being so far away from home at night time. Mr. Sulzer started for Switzerland immediately a committee of about a dozen chased him down stairs and two blocks down the street, but he was too quick. Some people cannot sprint very well after 3 o'clock in the morning, after absorbing too much ginger fizz anyway. The committee came back and reported that their guest was last seen going towards Canada, time 2:27 1-2.

John Hill was asked for his opinion of the flying machine. He said he had no opinions, sold them to the S. Obermayer Company at so much a year, and expenses. He promised to write and find out. He sat down—lucky he did, too, the bottle thrown at him missed its mark and hit a foundryman from Pennsylvania (name suppressed) in the neck. The latter gentleman never knew it, though 'till the next day—funny how the weather does prostrate some people, and the more medicine they take the worse they get.

John Meighan, of Dawson Brothers & Meighan, was asked by the president to give some reason why he should charge twice as much for facing to some concerns as he did to others.

Mr. Meighan replied that there were several reasons. In the first place, some people were better able to pay then others.

Then again certain people were not posted about prices as well as others, and some of the foundrymen who bought from him believed what he said about those matters and so the thing went. Mr. Meighan was told that he was master of his business, and every member present asked him to take a drink.

H. S. Vrooman, of Chicago, when asked to give a good reason why Chicago should not be taken off the map, said they had recently discovered plumbago there. Of course everyone was intensely interested, but for some reason or other Mr. Vrooman could not be very well understood, and amid cries of "Louder," "Three Strikes," "Out on First," etc., Mr. Vrooman subsided.

Mr. D. T. Root, of the P. H. & F. M. Roots Company, accounted for his presence by saying that he had intended to introduce the Root blowers to the gentlemen of the convention, but had found that all present were perfectly conversant with the best wind propeller in the world, and he had thought it was so much lost time, but the pleasures of this evening amply repaid him for the trip.

The latter portion of his remarks were almost lost owing to the fact that everybody wanted to either sing or talk or dance, and under the direction of the president, the balance of the session was devoted to singing all the popular songs of the day, after which the members who were able to walk escorted Howard Evans and J. M. Warner to the

Russell House, the balance being carried off in ambulances, cabs, etc.

It is still a matter of argument among some of those who stayed till the finish as to whether the meeting or the night broke up first.

Among the Foundries.

Peter Joyce, of Brattleboro, Vt., will reopen his foundry in the near future.

The Pratt Chuck Company will erect a new foundry at Clayville, N. Y., to be 161x61.

A. J. Goodrich has sold his brass foundry at New Haven, Conn., to A. B. Hendrix & Co.

The stove factory of Terrell & McClure is to be removed from Oskaloosa, Ia., to St. Louis.

The Hillsdale Furnace & Foundry Company are erecting an extensive plant at Hillsdale, Ohio.

The W. S. Hill Electric Company, of New Bedford, Mass., has added a brass foundry to its plant.

The Junction City (Ark.) Foundry Company has recently increased the capacity of its foundry.

John Sheffield and Charles Huntington expect to start a foundry and machine shop at Americus, Ga.

The Dutton Boiler & Engine Works of Kalamazoo, Mich., intend to add a foundry to their plant.

The Columbia Iron Works, Astoria, Ore., is represented as intending to increase the capacity of its plant.

The Semi-Steel Casting Company, of Montpelier, Ind., have been incorporated, with a capital stock of $10,000.

The Ideal Stove and Foundry Works are building a large plant in Daleville, Ind., for the manufacture of stoves.

The Southern Agricultural Works, at Atlanta Ga., is having plans and specifications prepared for a large extension.

The R. Stoever Foundry, at Myerstown, Pa., are said to contemplate the enlargement of their plant in the near future.

The Tyler Foundry and Machine Company has been incorporated, at Tyler, Tex., to engage in the general foundry business.

The Buckwalter Stove Company of Royersford, Pa., have lately erected a handsome building to be used for office purposes.

The National Brass and Iron Works, Reading, Pa., have begun the erection of a new building to be used for decorative work.

The Iola (Kas.) Manufacturing Company are erecting a number of buildings for the manufacture of all kinds of iron work.

The Floyd Wells Stove Company, of Royersford, Pa., is erecting an additional warehouse to its already extensive plant.

The East End Brass Foundry Company, of Cleveland, O., has changed its name to the Central Brass Manufacturing Company.

The Barb City Manufacturing Company, of De Kalb, Ill., is building an addition to its plant, which will be used for a foundry.

The Michigan Foundry Company, Battle Creek, has sold its plant to the Advance Thresher Company and has gone out of business.

C. B. Cottrell & Sons, of Westerly, R. I., have recently overhauled their foundry and increased their facilities for turning out work.

The Shields Foundry Company, of Mansfield, Mass., has been incorporated for the manufacture of stoves, etc. Capital stock, $6,000.

Many improvements and enlargements of capacity are now under way at the plant of the Whitney Iron Works Company, at New Orleans, La.

The Riverside Iron Works, at Wheeling, W. Va., lately visited by fire, is arranging for the immediate rebuilding of the destroyed plant.

Dietz, Schumacher & Boye, Cincinnati, intend to build a new factory next to their foundry, which will be run by power from the present plant.

The Indianapolis Stove Company has purchased the property of the Indianapolis Cabinet Works, and will rebuild and remodel the plant into a stove foundry.

The large foundry and adjoining buildings embracing the Northern Division of the Bath Iron Works, Bath, Me., which were vacated when the new plant of the Hyde Windlass Company opened, will be reopened in the near future by the Iron Works for making steel castings.

J. Waters, of 187 Seventh avenue, Brooklyn, N. Y., will erect a three-story foundry building, 33x76, on the corner of Bath avenue and Bay Seventeenth street.

George Bemarkt, proprietor of the West Side Foundry, Kansas City, Kan., has purchased a new site, on which will be erected a brick building to be used for a foundry.

The Newberry Manufacturing Company, of Newberry, S. C., will manufacture vehicles, operate foundry, machine shops, cotton ginnery, etc. A site has been purchased for the plant.

J. W. Miles and Geo. L. Clark have purchased the plant of the Howell Foundry Company, at Howell, Mich., which they will put into active operation as soon as needed repairs can be made.

The Reading (Pa.) Labor Exchange propose to establish a foundry for the manufacture of flat irons, which will be distributed among the 230 similar exchanges in the country in exchange for their manufacture.

The Summit Foundry Company, composed of James Quay, Roger Hogan and William Reid, who were formerly with the Phillips & Clark Stove Company, will engage in the stove making business at Geneva, N. Y.

The Marinette (Wis.) Iron Works Company has sold its plant to the American Sugar Machinery Company. Its purposes are to manufacture sugar machinery and to develop the beet sugar industry of the United States. The incorporators are Karl G. Horn, Fred W. Boldendahl and Chris Heinrich, of Milwaukee. The capital stock is $1,000,000, divided into 10,000 shares of $100 each.

The Ingersoll-Sergeant Drill Company, Havemeyer building, New York City, has been absorbed by an English company formed for that purpose, with a capital of $2,000,000. M. P. Grace, J. E. Dudley, R. W. Chapin and G. A. Phillips are the London directors, and W. R. Grace, John A. McCaul and W. L. Saunders the American directors. The factory of the American company is at Easton, Pa.

John Morren, for the past five years foreman at the Turner Machine Company's foundry, at Danbury, Ct., and for three years previous to that with the Delamater Iron Works, of New York City, his father, Andrew Morren, and William Calderwood are the members of a new company, to be known as the Danbury Iron and Brass Foundry. All the machinery and fixtures necessary for the fitting up of a well equipped foundry have already been purchased, and will be installed in the company's new building, now in course of erection.

Fire Fiend.

H. F. Bergeding's foundry, at Fort Wayne, Ind., was damaged by a small fire on June 12.

The foundry of J. Frakes, at 459 West Kinzie street, Chicago, had a small fire on June 17.

At Alexandria, Va., the Old Dominion Brass & Iron Works of William A. Moore & Son burned; loss $8,000.

Fire in Lauries Engine Works and Foundry, 1012 St. Catherine street, Montreal, Que., caused a loss of $2,000.

The Eagle Foundry, at Greensboro, N. C., was entirely destroyed by a recent fire. The company have advised us of their intention to rebuild.

The Gleason & Bailey Manufacturing Company, at Seneca Falls, N. Y., had a small blaze started in their works by sparks from the cupola.

The A. J. Lindemann & Hoverson Stove Company, of Milwaukee, were visited by fire recently. The greatest damage was done by water in flooding the building.

Prompt action by the fire department prevented a serious conflagration at the F. M. Watkins Foundry and Machine Works, Cincinnati, O. The damage is nominal.

The foundry of the George Sweet Manufacturing Company, at Dansville, N. Y., was damaged to the extent of $15,000 on June 1st. The loss is partly covered by insurance.

The machine and stove mounting shops of the Highgate Foundry Company, at Highgate, Vt., were entirely destroyed by fire June 19. The fire was discovered at 12:30 a. m., and before sufficient help arrived the flames had gained such headway that nothing could be saved. The loss is $6,000, with an insurance of $1,200. The works will be rebuilt. An effort is being made to have them remove to Champlain, N. Y.

Obituary.

WM. H. PERKINS.

Wm. H. Perkins, one of the owners of the Plymouth (Mass.) Foundry, died at Watertown, Mass., June 4.

JOHN HOUSTON.

John Houston, a member of the firm of Burr & Houston, iron founders of Brooklyn, N. Y., died on June 1, at his residence in that city, from paralysis, in the sixty-third year of his age.

LOUIS FROHMAN.

Louis Frohman, who died in Cincinnati, O., June 5, was born in Bavaria, Germany, in December, 1824. At the age of 17 he came to America and made Cincinnati or vicinity his home ever since.

Indirectly Mr. Frohman has been connected with the S. Obermayer Company for a great number of years, and for a short time became an active member as president of the firm.

Mr. Frohman had a host of friends among his business associates, to whom his word was as acceptable as his bond.

EDWIN DYER.

Edwin Dyer, for many years prominent in Chicago business circles, died at his home in Highland Park, aged 79 years. Together with James Gurney, of Boston, and Edwin L. Lamb, of Chicago, Mr. Dyer organized the Chicago Foundry Company, and located the works on the North Branch, at Stein and Redfield streets, in the vicinity of the North Chicago Rolling Mills. The company was incorporated in 1877, and Mr. Dyer became president. He retired from the company in 1880, having in the nine years of his connecton with it built up a business which marked him a successful man. He was then 62 years old, and did not again engage in active ventures.

Personal.

William H. Switzer has been elected president and general manager of the Superior Foundry Company, Little Falls, N. Y.

F. K. Potter, of Kokomo, Ind., has recently accepted a position as superintendent with the Cambridge Foundry Co., Cambridge, Ohio.

H. S. Vrooman, the well-known representative of the Garden City Sand Company, has started in business for himself at 220 West Twentieth street, Chicago. He will make a specialty of handling Fire Brick and Clay Molding and Core Sand.

Robert E. Masters, manager of the Marshall Car Wheel and Foundry Company, at Marshall, Texas, and one of the most prominent foundrymen in the southern states has resigned his position with the above named company to take effect July 31. During his ten years' connection with this company Mr. Masters has made for its product a name that is second to none. With his unceasing activity Mr. Masters has increased the output of the concern until it has reached 24,000 car wheels per annum, besides building up a large trade in other foundry work.

He has given especial attention to the railroad trade and the admirable qualities of his product have made him a favorite with western and southern railroad officials and his reputation has also reached several of the Mexican railway systems. Having been continually in harness for twenty-five years Mr. Masters intends to secure the benefits of a short vacation before again assuming his labors.

Industrial Education.

By industrial education alone can the young men of this country be taught how to work. The old apprentice system is dead here and in England. It is dying out all over the world. It did its work well, but the world has outgrown it. The conditions of society under which it was valuable no longer exist. The liberty of the lad was surrendered because the master took the responsibility of caring for him. The lad lived in his master's house as a member of his family, and the master worked with his men, and so could give personal attention to the training of his apprentice. Now the lad is hired to make himself useful, with the understanding that he is to pick up his trade as part payment for his services, and his success depends on his personal ability and on the sort of shop in which he chances to be employed.

It is idle to endeavor to revive the old system, or any modification of it. No attempt to control the lad's right to leave, when it seems to him or to his parents to be his in-

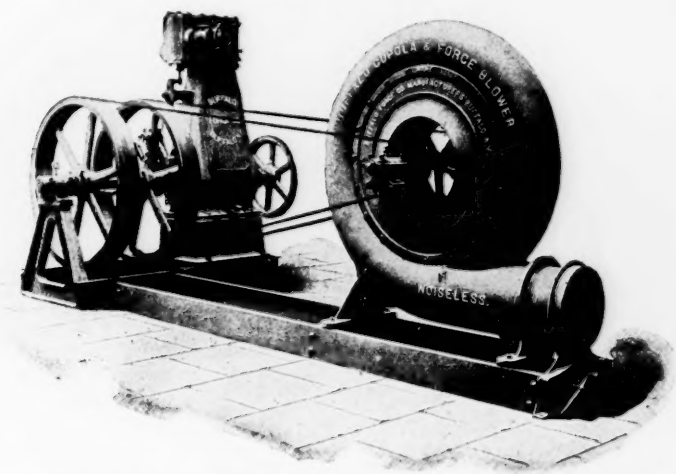
terest to do so, will be successful. Slavery in any shape cannot be revived in this country. If it is advisable for a lad to remain a length of time in the same shop—and I believe all are agreed that it is—you must make it clear to him that it is his interest to do so. You must make him realize he is not merely getting a temporary living, but is gaining knowledge which will give him a competency and may yield him a fortune. He should be encouraged not only to learn how to work, but to try to understand all that bears even indirectly on his work. He should be taught to write well, to express himself well, and to draw. With a system of industrial education this can be done. In private shops it can only be done by the aid of industrial schools. With such schools it is possible to train in a few years a class of American workmen who would be the best in the world.—Sanitary Plumber.

Steel Pressure Blower With Engine and Countershaft.

The illustration presented herewith shows a combination of pressure blower, countershaft and engine on one bed. Blowers driven from the countershaft or line shaft of a shop are generally limited to one speed. In many classes of work this is a great disadvantage. If the blower is being used for cupola work, it is most desirable that the speed be changed at will, giving the foundryman complete control over the blast. Sometimes it happens that a shop is provided with ample boiler capacity, but has limited engine capacity, so that it is impracticable to run the blower from the shop shafting. Again it may be that the foundry is so situated with regard to the rest of the institution that an independent outfit is absolutely necessary. Under these and many other conditions an arrangement of this kind is especially adapted. The Buffalo Forge Co., of Buffalo, N. Y., are the manufacturers.

Making and Selling.

It would be better for both employer and men if they were more familiar with each other's affairs; for while the former, occasionally risen from the ranks himself, probably knows more of the manufacturing than the employe does of the selling part of the business, a common knowledge of both is often lacking. The price of every commodity, be it a milling machine or a tenpenny nail, must bear a percentage of expense which represents the cost of selling it, whether that selling is done by the manufacturer through his salesmen or by an agent or dealer. If people could or would buy direct from the maker, the cost of selling would be lessened in most cases; although few manufacturers—except those making special machinery, for the sale of which personal communication is necessary—have the means or organization to market their own product direct.



STEEL PRESSURE BLOWER WITH ENGINE AND COUNTERSHAFT.

In addition to the cost of selling must be considered the office expense, the interest on investment (often borrowed money), deterioration of plant, experimental work to keep abreast of competition, bad debts which are contracted in spite of every care, catalogues and other advertising necessary to make the product known, and many smaller items which enter into the expense of every business. All these must be provided for before any profit appears. The men too often imagine that the difference between the cost and selling price is clear profit, or nearly so, and the result of this belief is seen in the too frequent failures of co-operative stores and factories, the successful ones having evidently learned to allow for the selling as well as the manufacturing cost.

The effect of this belief is to make the men discontented when they figure out this apparent profit, and the sooner it is thoroughly understood that the cost of selling is frequently more than the cost of making, the sooner some of the friction will be lessened. We do not say that the net profit is always as low as would be considered a fair return for money invested, or that the men always receive a just share of the products of their labor; but we wish to make clear the fact that making and selling are two very different things, in the belief that a clear understanding will be better for all concerned. The conditions which necessitate such an effort to dispose of manufactured articles, may be at fault, but as they exist we must deal with them as we find them.—Machinery.

NOTICE!

Advertisements in this column, 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than the 20th to insure publication.

Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, we will give one free insertion under this heading to those in want of positions, the advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

FOR SALE—No. 3 Root blower, used only a few months; to be replaced with largest size. Address Box 4, care THE FOUNDRY PUBLISHING CO.

A SUPERINTENDENT of a malleable iron works, at present employed, desires to make a change. References. Address Box 81, care of THE FOUNDRY.

WANTED—Situation by party with several years experience as business manager of a foundry and specialty manufacturing company. Address box 83, THE FOUNDRY.

WANTED—Position by foundry foreman at present engaged in a modern foundry; 27 years' experience; references upon application. Address Box 74, care THE FOUNDRY.

SITUATION WANTED—By a thoroughly competent man, both as a mechanic and manager, to assume charge of foundry plant, proficient in economical production. Has experience. Can furnish reference. Address Box 58, care THE FOUNDRY.

WANTED—A machinist or a molder with one to two thousand dollars to invest in an established western manufacturing plant. Good position and income from investment assured to the right party. Address Box 80, care THE FOUNDRY.

FOUNDRY for sale, all complete, with a capacity of 150 tons castings per month; a fine opportunity for one with a limited capital to engage in the foundry business. For further particulars apply to Colvin Foundry Co., 164 West Exchange st., Providence, R. I.

ANY ONE IN NEED of a practical machinist or molder to take charge of machine shop or foundry or both, having been general superintendent of a large manufacturing company for the last nine years; can give best of references; make mixtures of iron on analyses. Address Box 79, care THE FOUNDRY.

WANTED—Position as foundry foreman by a thorough mechanic, who has held similar positions for 22 years. Capable of producing any class of work except stove and hollow ware. Best of references from last employer for 5½ years' continuous service. Address Box 78, care THE FOUNDRY.

WANTED—Situation as Chemist or Superintendent, by an experienced man who can furnish both references and recommendations from both past and present employers. Understands all kinds of foundry work and can mix irons for any purpose to the best advantage. Address Chemist, Box 82, care THE FOUNDRY, Detroit, Mich.

WANTED—Situation as foundry foreman by one who has had ten years' experience as foreman on all classes of work. Thoroughly capable of handling a foundry in all its details. Can manage men to the best advantage and understands the melting and mixing of iron to obtain different qualities. Can give the best of references as to character and ability. Address Box 53, THE FOUNDRY.